LOGISTICS CONTROL FACILITY: A NORMATIVE MODEL FOR TOTAL ASSET VISIBILITY IN THE AIR FORCE LOGISTICS SYSTEM

THESIS

Eric C. Lorraine, Captain, USAF
Michael E. Michno, Captain, USAF

AFIT/GLM/LAL/94S-25

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GLM/LAL/94S-25

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Master of Science in Logistics Management

Eric C. Lorraine, B.S.
Captain, USAF

Michael E. Michno, B.S.
Captain, USAF

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Preface

The purpose of this study is two-fold. Initially, a conceptual model of a logistics control facility with an information system providing total asset visibility was developed. After developing the model, portions of it were tested using the RAND Corporation's latest simulation platform, Dyna-METRIC Version 6. Two performance measures, expected fully mission capable rates and expected pipeline quantities, were used to evaluate the results of the simulation model.

During the research effort, several individuals provided us with a great deal of help and encouragement. First and foremost, we are deeply indebted to Greg Holevar of Air Force Materiel Command for his support and assistance throughout the study. We also wish to thank Bill Stringer from the Dynamics Research Corporation for his imparting of many years of logistics experience to us and his guidance in the research effort. We also express our gratitude to our thesis advisors, Major Judy Ford and Major Michael Morabito, for their enthusiasm and assistance in times of need. Finally, we especially want to thank our families for their understanding and encouragement during the entire research process.

Eric C. Lorraine
Michael E. Michno

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Abstract

Computer simulation was used to evaluate the impact of a Logistics Control Facility (LCF) with a Total Asset Visibility (TAV) system on the AF logistics system's ability to support a weapon system. For this study, the B-1B was chosen as the weapon system of interest. Two performance measures, expected fully mission capable rates and expected pipeline quantities, were used to evaluate the simulation results. Two-sample *t* tests were used to compare the current logistics configuration of the B-1B with that same configuration, but with an LCF controlling the movement of assets. The expected FMC rate performance measure showed significant results while the expected pipeline quantity performance measure did not. After determining that the LCF with a TAV system did have an impact on the ability of the AF logistics system to support a weapon system, fourteen different support configurations were evaluated. Variables included mode of transportation, use of buffer stocks, and use of intermediate repair facilities. Analysis of the results was accomplished using a randomized block ANOVA and Least Significant Difference comparison of means. For expected fully mission capable rates, mode of transportation was the most significant factor. For expected pipeline quantities, the use of intermediate repair facilities was the most significant factor.

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I. Introduction

Chapter Overview

This chapter provides a background for the research topic of a central control agency using a system providing total asset visibility (TAV) in the Air Force logistics system. The general issue of the research, the problem statement, the research objectives, and the investigative questions for the research are presented. Additionally, the chapter presents the limitations and scope of the research. Finally, it provides definitions for the terms total asset visibility, lean logistics, two-level maintenance, and logistics pipeline.

General Issue

Computers, information systems, and communication systems are being increasingly used in transportation, warehousing, order processing, materials management, purchasing, and procurement (Lambert and Stock, 1993: 14). In other words, every area of logistics is affected by the technological revolution and development in computers and information systems.

In 1987, Robeson identified the top three logistics trends as follows:

> 1. The rapid proliferation of data processing systems enables the distribution or logistics organization to handle and control information in ways that will change the traditional methods of servicing customers and supplying products.
>
> 2. Advances in computer technology will allow electronic data interchange to be pervasive by 1995. All phases of logistics will be involved, and communication technology will create opportunities for large savings.
>
> 3. The major difference between the logistics operating environment of 1995 and that of today will be the improvement in the timeliness and completeness of the exchange between channel members. (Robeson, 1987)

The advent of computer technology has impacted all facets of the Air Force logistics system. The Air Force currently operates numerous information systems in an attempt to capture the enormous amounts of data produced by its logistics system. A few examples include the Depot Maintenance Management Information System (DMMIS), the Reliability and Maintainability Information System (REMIS), the Core Automated Maintenance System (CAMS), and the Standard Base Supply System (SBSS). However, the Air Force currently does not have a system providing TAV. There is no stand-alone information system available that can accurately determine the location of all of the assets in the Air Force logistics system. The end result is that the Air Force still uses traditional methods of servicing customers and supplying products. The opportunities for significant savings due to communication technology have not been realized, and the timeliness and completeness of information between segments of the Air Force logistics system is insufficient.

Another principal problem with the current logistics system is that there is no central agency controlling the movement of assets through the logistics pipeline. The idea for a centralized logistics control agency was conceived during Operation Desert Storm/Shield. Greg Holevar, Team Coordinator, Combat Readiness and Resources, Headquarters Air Force Materiel Command, realized there were several deficiencies in the Air Force's attempt to improve asset visibility. He saw that each major area within the logistics system had their own system working at various stages within the pipeline. In other words, maintenance personnel were tracking assets in their portion of the pipeline with maintenance information systems, and transportation personnel were tracking their portion of the pipeline with transportation information systems. However, these systems had serious shortfalls and left the customer tracking assets blind to their status in several areas of the pipeline.

These system shortfalls during Desert Shield/Storm, and the inability of the systems to share information with each other was the catalyst that drove the logisticians at Wright-Patterson Air Force Base to develop their own asset visibility system. This system is known as AFLIF, the Air Force Logistics Information File (Holevar, 1993).

In addition to AFLIF's development, a review was being conducted on the Air Force's Air Clearance Authority (ACA). In the ACA, cargo is released into the airlift system on computer based criteria. Even when an aerial port is overflowing with cargo, if new cargo meets the system's criteria, the cargo is accepted into the system. The cargo is sent by the shipper to the port to add to the overflow confusion. To fix this confusion during Desert Storm/ Shield, the Air Force added human intervention into the system. Air Force personnel were sent to the aerial ports to decide what went first and what could wait. With all the computer systems the Air Force had, it still did not have the visibility of its assets, or the ability to control them within the logistics pipeline.

It was the combination of these things that led Greg Holevar to think of an agency within the Air Force to control the flow of assets in the pipeline. He realized that the Air Force had over-systematized the logistics process and had left little room for human intervention. His thought process became the cornerstone for the concept of a Logistics Control Facility (LCF), for which this thesis is based. The LCF uses asset visibility systems as a tool to effectively and efficiently control the logistical needs of weapon system users. The LCF uses the information available in acquisition, transportation, supply, and maintenance systems to make intelligent decisions in order to support the needs of the Commander-in-Chief during contingencies. In peacetime the LCF would use the information available to help weapon systems maintain in-commission rates and minimize costs by reducing inventories (Holevar, 1993). In a business such as war where the visibility of supplies in the pipeline can be the difference between life and death, the United States Air Force has much work ahead. However, the private sector has realized the importance of this visibility, and many companies use it for competitive advantage.

Several companies in the private sector, such as Federal Express and United Parcel Service, can provide complete item visibility to their customers because they control the entire process. (Woodworth, 1993: 17). No Air Force organization can presently do this. The Air Force logistics pipeline is a complex system with numerous activities linked together in order to maintain weapons systems at minimum peace time readiness rates and to support wartime commitments. While the interactions within the activities of the system may be well-managed, the interactions between agencies may cause inefficiency and inadequate control of critical assets (Bond and Ruth, 1989: 1).

Problem Statement

In the past few years, several changes in the way the Air Force carries out the business of logistics have been instituted. Two-level maintenance is well on its way to being instituted Air Force wide (Two-Level, 1992: 11). "Lean logistics" is the latest attempt to improve the effectiveness of the Air Force logistics system (Pyles and Cohen, 1993: 3). The cost of the Air Force logistics system runs into billions of dollars every year, and the concepts of two-level maintenance and lean logistics are being implemented in an effort to reduce the cost of the Air Force logistics system. For these concepts to truly reach their maximum effectiveness and to minimize the costs associated with the logistics system, a total asset visibility system needs to be in place with a centralized control agency directing the activities of the logistics system.

Research Objective

The research objective is to develop a conceptual model of a total asset visibility system under the control of a centralized agency, and then to test portions of the conceptual model to determine its impact on the logistics system of the Air Force. A Dyna-METRIC model will be used to assess the capability of the Air Force logistics system under these conditions.

Investigative Questions

1. How are computers and information systems used by U.S. industry for competitive advantage?

2. What information systems are currently in use by the Air Force?

3. How can these information systems be used to provide a TAV system to the Air Force?

4. How should a centralized control facility be organized to effectively and efficiently direct the activities of the Air Force logistics system?

5. What effect does a TAV system employed by a centralized control agency have on the ability of the current Air Force logistics system to support weapon systems?

6. With a TAV system in use by a centralized control agency, what is the optimal configuration for the Air Force logistics system?

Limitations

The scope of the Air Force logistics system is enormous to say the least. Three specific limitations are required to narrow the scope of the research effort.

1. The model will assume a peace time environment, however it should be noted that TAV is extremely important for logistics managers in a war time environment.

2. The model will be limited to B-1B bases in the Continental United States (CONUS). Currently, the B-1B is maintaining mission capability rates between 50-60 percent,

well below the 75 percent standard (Government Accounting Office, 1994: 7). Obviously the opportunity exists for improvement in the readiness for the B-1B. Consequently, it was chosen as the weapon system to use for this research.

3. The model considers only line replaceable units that are candidates for the readiness spares package currently being developed for the B-1B. Consumables are not considered since reparables represent the greatest opportunity for cost savings (Stringer, 1994).

Definitions

Specific definitions are provided to provide a common foundation for the reader.

1. **Total Asset Visibility** is the capability of both operational and logistics managers to determine and act on timely and accurate information about the location, quantity, condition, movement, and status of Air Force assets (Department of the Air Force, 1993: 3).

2. **Two-Level Maintenance** is the concept being implemented in the Air Force which relies on the organization (flight line) and depot levels as the primary sources of maintenance. It reduces dependence on the field (intermediate) level maintenance to reduce manpower costs (Department of the Air Force, 1993: 3).

3. **Lean Logistics** is a five-point concept that changes the traditional approach to logistics. It begins with the orientation of the system to the user, proceeding through

more responsive "Just-In-Time" style production and distribution processes, more responsive suppliers, greater integration of logistics with the design and acquisition system, and ending with a system of continuous improvement (Pyles and Cohen, 1993: 4).

4. **Logistics Pipeline** is a network of repair and transportation channels through which repairable and serviceable parts flow as they are removed from their higher assemblies, repaired, and requisitioned from other points of supply (Isaacson and others, 1988: xv).

5. **Consumable** refers to the class of assets which are more economical to replace than repair. Consumable items lose their identity in use (Stringer, 1994).

6. **Reparable** refers to the class of assets which are generally more economical to repair than replace. Reparable items do not lose their identity in use (Stringer, 1994).

7. **Repairable** describes the physical condition of an item when it is broken (Bond and Ruth, 1989: 6).

Scope

This study concentrates on areas of the logistics system that stand the most to gain from adopting commercial business practices. Consequently, the research effort focuses on improving the efficiency of the logistics pipeline. To improve the efficiency of the pipeline, the research effort analyzes the movement of reparables between activities in the pipeline. This study will not examine the processes within the activities of the pipeline, but rather the movement and control of assets in the pipeline.

Initially, a conceptual model of the logistics pipeline will be constructed with a TAV system and centralized control agency in place. The conceptual model will then be encoded using Dyna-METRIC Version 6, an advanced capability assessment model developed by RAND.

Experiments with the Dyna-METRIC model will be performed and the output will be compared with current data. Specifically, mission capability rates produced by the model for various support configurations are compared to the mission capability rates produced under the current logistics pipeline. Additionally, the number of assets in the pipeline produced by the model are compared to the number of assets in the pipeline under the current system.

Chapter Summary

This chapter describes the nature of the research effort. The general issues of inadequate information systems and lack of centralized control in the Air Force logistics system are presented and the problem is defined. The research objective and investigative questions for the study are also introduced. Finally, the limitations and scope of the research effort are described in this chapter. Chapter II provides a review of current literature on the use of computers and information systems in both private industry and the Air Force.

II. Literature Review

Introduction

The political and economic realities of the world today demand that Air Force managers seek alternatives to improve their overall operations. In today's era of constant change, Air Force logisticians have the opportunity to make significant improvements in the Air Force logistics system.

In 1992, the Secretary of the Air Force approved the implementation of two-level maintenance for existing weapons systems and instructed the Air Staff to develop a plan to convert each weapons system to the two-level maintenance concept within five years (Two-Level, 1992: 41). The latest concept, "lean logistics," was introduced in a 1993 study that looked at incorporating the new business practices of lean production and Just-In-Time (JIT) distribution into the Air Force logistics system (Pyles and Cohen, 1993: 3).

As the Air Force moves toward the 21st century, it will continue to benchmark the practices of private industry to improve the effectiveness and efficiency of the Air Force logistics system (Pyles and Cohen, 1993: 2). Private industry is employing new strategies to satisfy customer demands. The successful implementation of these strategies is due mainly to the application of computer technology to the logistics systems of private industry. Success is defined here as improving customer service and reducing logistics system costs (Schary, 1992: 345).

A brief overview of the emerging business practices in private industry is followed by a discussion of the employment of computer technology by private industry to improve operations. Next, a discussion of the methods used currently by private industry to use information for competitive advantage is presented. Finally, the Air Force logistics system is examined and the critical improvements required in its attempt to catch up with their corporate counterparts.

Emerging Business Practices

Throughout the 1980s, American industry changed the way it carried out its day-to-day operations. Corporations changed to new strategies to stay competitive in the emerging global marketplace. The most common new strategy was to look at the logistics system for ways to reduce costs and improve customer service.

Traditionally, managers paid little attention to their logistics systems. The typical philosophy was: "If you're smart enough to make it, aggressive enough to sell it - then any dummy can get it there" (Shapiro, 1984: 126). This philosophy was a factor in American industry falling behind its world competitors. To become more competitive, managers reexamined the concept of customer service. Logistics managers became proactive, designing systems to meet customer needs (Schary, 1992: 341). Customer service in logistics is more than rapid delivery or product availability. It is a means of meeting the demands of the customer for efficient supply operations (Schary, 1992: 342).

Today, managers also look at customer service from a systems perspective. American industry is carefully scrutinizing the characteristics of their logistics systems when developing customer service strategy (Schary, 1992: 346). Traditionally, inventory was used throughout the individual stages of the supply chain to act as a buffer against inefficiencies in the system, but this was a costly solution (Schary, 1992: 347). Today, industry considers the supply chain as a single entity for faster, more flexible response to minimize total throughput time and inventory costs (Schary, 1992: 347). The JIT distribution system works in such a manner.

Today's successful corporations are improving the productivity of their logistics systems to stay competitive in the marketplace. By increasing the productivity of the its logistics system, a firm is well on its way to meeting customer needs at a minimum overall cost (Kettner, Wheatley and Peterson, 1992: 219). Firms that can compete effectively with a productive logistics system tend to be good at other things as well, such as consistency of product quality (Stalk, 1992: 57).

To implement these new strategies, firms are using the power of the computer as their primary tool. The rapid proliferation of computer technology enables the logistics organization to control information in ways which are changing the traditional methods of servicing customers and supplying products (Stock, 1990: 134). The three major impacts of computer technology are: time compression, reorganization of the relationships between buyer and seller, and the elimination of geographical restrictions . These impacts play a key role in a firm's operations and on the management of its resources, especially inventory (Hammer and Mangurian, 1987: 65).

Employment of Information Technology

Information technology significantly impacts the operations in both service and manufacturing industries (Udo, 1993: 33). The growth and capabilities of information technology have tremendously impacted how business is conducted. Two technologies that experienced substantial growth in the past four years were electronic data interchange (EDI) and bar coding (Logistics, 1992: 104).

EDI. EDI is an example of telecommunications that significantly improves business operations (Udo, 1993: 33). Udo defines EDI as "a direct computer-to-computer communication between two organizations via a telecommunications system" (1993: 33). EDI differs from other types of information systems because data are transmitted in the actual forms and formats instead of as text messages. Transactions traditionally performed on EDI include purchase orders, invoices, and bills of lading.

EDI transactions are transmitted through direct dialing, private data networks, public data networks, and managed data networks (Janssens and Cuyvers, 1991: 48). EDI also requires that hardware at both ends maintain a certain degree of compatibility. Presently, EDI operates on a batch-processing mode, but this mode will be phased out as on-line processing is developed (Udo, 1993: 34). It has even been suggested that "event-driven" EDI will be developed in which transactions are triggered by events (Barber, 1991: 40).

EDI has proven to be a cornerstone of improved inventory management for many firms because it eliminates many of the problems associated with traditional information processing (Udo, 1993: 34). Among the problems eliminated by EDI are timeliness, backlog, and data re-entry. Since EDI features single data inputs, entry errors are minimized and time is saved.

The use of EDI also showed steady growth from 1990 to 1992. Respondents to one survey reported that 20-25 percent of their transactions with customers' warehouses were conducted with EDI in 1992. Growth of EDI is anticipated to reach 50-60 percent of all transactions by year 2000 (Logistics, 1992: 104).

Yellow Logistics Services employs EDI to update inventory status and pay carriers and warehouses. According to Jim Bramlett, director of operations for Yellow Logistics Service, accurate and timely information on inventory status is imperative to compete in today's marketplace (Schulz, 1993: 51).

The list of firms reporting substantial benefits from the employment of EDI is long. Following are a few examples.

1. Pacific Bell saved $2 million per year by reducing its inventory by 5000 items using EDI (Evans-Correia, 1989: 83).

2. Hewlett-Packard reported a 1-2 week reduction in delivery dates, a 35 percent savings in mailing costs, and a 5 percent reduction in administrative errors by employing EDI (Janssens and Cuyvers, 1991: 49).

3. Digital Equipment Corporation reported a 75 percent reduction in order-processing costs by employing EDI (Barber, 1991: 35).

While purchasing and transportation have been the beginning points for EDI in numerous organizations, other applications exist throughout the manufacturing cycle. The use of EDI in applications such as quality, design, scheduling and production control offers organizations even greater benefits than those experienced to date. For organizations to stay competitive in the 1990s and beyond, EDI is a necessity (Barber, 1991: 35).

<u>Bar Coding</u>. The ultimate goal of bar coding is to reduce costs and streamline the flow of accurate information about inventory as it moves through the supply pipeline (Forger, 1993: 50). Bar coding helps the logistics manager get the right inventory to the right place at the right time. Bar coding does this by reducing picking and shipping errors, helping to ensure orders are filled correctly. Fewer shipping errors lead to fewer unsatisfied customers and reduces the costs, such as expedited shipping, of correcting the errors.

Bar coding, like EDI, also showed steady growth from 1990 to 1992. Shipments received from vendors with bar codes encompassed 25 to 30 percent of all shipping volume in 1992. In addition, growth of bar-coding activity is anticipated to reach 40 to 50 percent of all shipments by 2000 (Logistics, 1992: 104).

At the Weyerhaeuser Company's lumber mill in Snoqualmie, Washington, a data collection system was installed that included bar code label printers and hand-held scanners. The system was installed to improve production and inventory tracking. Since installing the system, the mill cut packaging costs significantly and improved reporting accuracy. At the same time, the elimination of time-consuming manual operations improved boost customer service levels (Bar Code System, 1993: 69).

Archives Management of New Jersey turned to bar coding for tracking the million documents they store for other companies. Prior to bar coding, tracking was done by noting locations on paper. With the inventory continuously moving, the method proved to be error prone and time consuming. Since the implementation of the bar coding system, the time it takes to find a customer's document has been reduced and billing errors are virtually non-existent (New Bar Code, 1993: 73).

The United States Postal Service implemented bar coding for the movement of mail. Bar coding revolutionized the movement of mail while enabling customers to reduce their costs. Bar coding speeds the processing of mail, allows the Post Office to process the mail more efficiently, and saves the customer money (Adkins, 1992: 38). The customer saves money because a bar coded letter requires less handling by the Post Office. A standard 29-cent letter costs just 23.3 cents if it is bar coded, a 14.5% savings. As a result, numerous organizations throughout the US are employing bar coding technology in their mailrooms to take advantage of the savings (Adkins, 1992: 38). The U.S. Postal Service will continue to raise postal rates to keep pace with the economy. Bar coding represents the most effective way that users and manufacturers can help to offset the raise in postal rates.

Federal Express and United Parcel Service provide complete visibility of a shipment for a customer using bar coding (Woodworth, 1993: 17). Both firms use bar coding to ensure correct and accurate shipment movement data is available for the carrier or the customer. Each firm is able to determine shipment location at anytime, in a terminal, in a truck, or in the air (Woodworth, 1993: 17).

Bar coding is a technology that has seen rapid growth over the past few years and should continue to grow. Bar coding at the warehouse improves data collection accuracy, reduces receiving operations time and data collection labor, and helps to integrate data collection with other areas. On the retail side, bar coding enables the retail outlet to closely monitor sales and inventory levels. The instantaneous transmission of data allows the retailer greater control of its inventory (Coyle and others, 1992: 412).

Employing Information for Competitive Advantage

The remarkable growth of JIT distribution systems resulted in an increased demand for immediate data on shipments. Experts say JIT will be the dominant shipping mode of the future. Projections for the year 2000 for JIT shipments are between 65-75 percent of the total shipping volume (Logistics, 1992: 104).

The JIT environment requires a closer relationship between a firm and its suppliers and successful JIT implementation requires clear and frequent communications with suppliers (Udo, 1993: 35). Computer technology plays a critical role in establishing the JIT-required relationships. Computer technology provides the means of linking geographically separated firms and suppliers and allows them to communicate continuously.

Trucking company services, a vital component for successful JIT implementation, cannot be effective without computer technology (Udo, 1993: 35). Two-way communication, both data and voice, between the firm, trucking company, and supplier is provided by computer technology. When unavoidable delays are present, the information is communicated instantly through the use of computers so that the necessary actions can be taken. To satisfy the demand for information about JIT shipments, many companies utilize satellite tracking to keep abreast of cargo movement.

Satellite tracking gives the shipper the information needed for tracking JIT shipments and offers several advantages to the carrier. Using satellite tracking, the carrier gets:

1. Tighter estimated times of arrival,
2. Around-the-clock monitoring of sensitive items,

3. Cost benefits due to more effective use of its fleet,
4. Increased productivity and safety for its drivers, and
5. Better managed cargo with improved response time to customers. (Akard, 1993: 30)

Ranger Transportation, Incorporated uses satellite tracking on its fleet to keep informed about its customers' cargo (Akard, 1993: 30). The satellite tracking system employed by Ranger allows them to locate a vehicle within seconds and send a message to the driver (Akard, 1993: 31).

Time-based competition requires that firms respond quickly to market demands without increasing price or reducing quality. It is a long-term strategy that focuses on the customers instead of the processes that provide the product or service. Companies such as Toyota, Motorola, and Miliken gained a competitive edge by using time-based competition as a strategy. For these companies, the strategy led to higher profits and increased customer satisfaction (Udo, 1993: 35).

Time-based competition is difficult to implement because it requires a high degree of automation and integration within an organization. The organization's ability to manage its inventory is one of the keys to success in time-based competition. To reduce product development times, manufacturing/assembly times, and delivery times, an organization must be efficient in its inventory management. In time-based competition, inventory management performance is measured in terms of inventory costs, availability of the right items, and timeliness of acquiring the necessary amount of materials (Udo, 1993: 35).

Computer technology is an essential component in time-based competition. The ability of computer technology to automate operations and integrate different physical units is essential for success. Computer technology's abilities to eliminate constraints posed by time, geographic location, or organizational boundaries will become critical as more organizations turn to time-based competition for survival (Udo, 1993: 35).

Many other firms use information to compete in the marketplace. Order status information is a key customer service performance variable (Morash, 1990: 58). Prompt and courteous handling of customer inquiries as to shipment location and condition can sway a customer to a supplier (Christopher and others, 1979: 18). Yellow Logistics Services "married" their transportation and inventory management information systems in a real-time environment to accurately track customer orders (Schulz, 1993: 51). United Airlines is using information as a key part of their marketing strategy. John Flynn, United Airlines Cargo Automation Manager, states "I don't think the other airlines want to compete with information" (Page, 1993: 55). The information age brought with it extraordinary capabilities. The firms taking advantage of these capabilities are thriving in today's marketplace (Udo, 1993: 33).

The Air Force Logistics System

The Air Force is working frantically, both alone, and with the Department of Defense, to catch up to the civilian corporate logistics communities. In Vietnam, the military called the problem of asset tracking and identification the "gray box." In Desert Storm not much had changed, and the problem still existed. Somewhere between 20 and 30 thousand containers and uncounted air pallets had to be opened every time someone wanted to know what was inside, or who was to get the container (Tuttle, 1993: 15). The Air Force has much work ahead in order to have visibility of its assets within its logistics system. While assets are visible in some Air Force systems, the same assets are invisible in other segments of the pipeline. A constant complaint during the days when the Air Force had its own contracted air carrier, known as LOGAIR, was, "Where is my part now?."

AFLIF, the Air Force Logistics Information File, was a real breakthrough in establishing visibility of Air Force cargo, both in the supply and transportation pipeline. This system was AFLC's commitment to provide in-transit visibility, and was a first real visibility tool for supply and maintenance troops (Figueroa, 1992). LOGAIR was terminated on October 1, 1992 by order of the Secretary of the Air Force (Holevar, 1993). With its departure a large portion of the Air Force cargo visibility was lost.

Much of the old LOGAIR cargo was transferred to movement by Federal Express, United Parcel Service or Emery Air Freight. Most senior Air Force Logisticians felt this would solve the Air Force's asset visibility problem. It did, but only partially. The commercial air carriers are able to give status of parts while in-transit, but for the military this is only a small piece of the puzzle. The true logistical puzzle is an aggregation of several levels of supply, transportation, procurement, depot level repair and base level repair (Department of the Air Force, 1992: v). Another problem encountered was much of the cargo was diverted from LOGAIR to surface movement. With most surface movement, no visibility is present. Often the complaints are still, "Why can't the Air Force track its cargo like Federal Express?" The answer lies in that Federal Express, or any of the air freight carriers, are not like the Air Force. Their logistical system is a self contained entity. Federal Express and UPS do not have to worry about tying various facets of logistics together. Federal Express and UPS do not have to integrate a supply and logistical process with the shipment process; the Department of Defense does (Woodworth, 1993: 17).

Air Force Materiel Command, as well as Joint Department of Defense organizations, are attempting to complete the loop on the development of a true Total Asset Visibility (TAV) system. U.S. Transportation Command, headquartered at

Scott Air Force Base in Illinois, has undertaken the task of completing the transportation portion of this system. They would be the Department of Defense's agency responsible for in-transit visibility (Tuttle, 1993: 16). While in-transit visibility is important, it only provides one piece of the puzzle of what true TAV represents.

True TAV is a network system that gives supply, maintenance, or any user, the tool to know where their part is in the supply, transportation, maintenance or acquisition pipeline (Holevar, 1993). Once the information is available, an effective TAV system will allow someone to use the system to change the preplanned direction of asset flow. A question that arises in most in-transit visibility discussions is "what do you want to do with the information?" Knowing where things are is helpful, but not nearly as much as being able to use the information to change courses of action (Wykle and Wolfe, 1993: 10). The Air Force Air Clearance Authority (ACA) is primarily concerned with the efficient movement of cargo into the airlift system. Its mission is to control the flow of cargo into the aerial port (Larberg, 1992: 25). The ACA clears cargo into an aerial port on the merit of whether it meets computer generated requirements or not. The fact that an aerial port is backlogged is irrelevant; cargo either meets requirements, or does not. This limits the customer's response in selecting the best mode for asset transportation. The ACA would be a prime user of a TAV system (Holevar, 1993).

In order for the Air Force to have the visibility to effectively control its logistics pipeline, like its civilian counterparts, a system of TAV is desperately needed.

Current Systems

Currently the Air Force has a multitude of systems at each level within the logistics pipeline. Each system has a specific purpose for its own area of logistics, but they do not all provide real-time asset visibility, nor do they share information between systems (Holevar, 1993). Assets that are visible through a transportation system, may lose their visibility once accepted into a depot level supply or maintenance system. The Air Force and DOD are actively trying to create a true TAV system. In this thesis, a conceptual model of an Air Force Logistical Control Agency (LCA) will be proactive in the movement of assets to support a selected sample of test bases. The tool used by the LCA to aid in the distribution of assets to the test bases is a TAV system. A TAV system needs a combination of available information from acquisition or procurement, supply, maintenance and transportation systems (Holevar, 1993). The construction of a normative TAV system includes several subsystems from each logistics concentration.

Acquisition System Inputs. The Item Manager (IM) is responsible for the purchasing and inventory management of assets in the Air Force. Newly procured assets are probably a last source for asset diversion under an LCA concept; however, they could be diverted to fill an urgent need. According to George Zeck, Item Repair Determination Policy Branch, Headquarters Air Force Materiel Command, during a 26 April 1994 interview, the systems that are most critical for world-wide asset tracking and availability of newly procured assets are the DO35A, the DO35K and G402A.

DO35A. This one is part of Stock Control & Distribution (SC&D) System, and does the world-wide tracking of all asset and assets backorders. DO35A, Item Manager Wholesale Requisition Process (IMWRP), of the SC&D system contains those functions related to customer support, property accounting, inventory control point (ICP), management products, cataloging/management control data, data visibility and external system interface (Department of the Air Force, 1987: 2-4).

DO35K. The Depot Supply Stock Control and Distribution System is the wholesale and retail, receiving and shipping section of SC&D. It provides some of the functions for customer support, compute retail requirements, property accounting, produce management reports, cataloging/management control data, data visibility, external system interfaces, material receiving, storage, and inventory processing. The DO35K also provides information on backorders, supply balances, due-ins, daily transactions and floating stock data (Department of the Air Force, 1987: 2-6).

G402A. The Exchangeable Production System (EPS), is an active on-line system that provides three major functions: (1) management of items subject to repair (MISTR) scheduling, (2) material support, and (3) front-end processing for the DO35K (Financial, 1992: 24).

Supply System Inputs. Supply information needs to be available for the TAV system from both base and depot levels. According to MSgt Barry Morgan, Supply Systems Analyst, Headquarters Air Force Materiel Command, during a 2 April 1994 interview, the two main systems that need to be included within a TAV system to provide the base level and depot level supply information are the Standard Base Supply System (SBSS), and the Stock Control and Distribution (SC&D) system.

SBSS. The SBSS uses a computerized system to account for supplies and equipment at the base level. Within this system, personnel can track every item in the Supply System through standardized programs and procedures (Department of the Air Force, 1991: 1-5). SBSS provides the needed information about processing issues, due-outs, due-out requisitions, receipts, turn-ins, and shipments. SBSS is an accounting system providing base activities with their supply needs and accounts for supplies, equipment, petroleum, oil and lubricants (POL), munitions and clothing (Department of the Air Force, 1991: 1-7).

SC&D. The requirement for SC&D was generated by the need to upgrade the Air Force Logistics Command stock control and distribution systems into a responsive, integrated system (Department of the Air Force, 1987: 2-4). There are three main tracks to the SC&D system: accounting, transportation, and management. The management and accounting tracks contain the most critical information necessary for a TAV system. The accounting track contains the following four subsystems:

DO35A. (See description under Acquisition).

DO35C. This section of the SC&D system shows Stock Record Account Number (SRAN) level quantities (Zeck, 1994).

DO35K. (See description under Acquisition).

DO35L. This section of SC&D is the Inventory and Storage Process of the system. It incorporates those functions related to the inventory/storage process (Department of the Air Force, 1987: 2-6).

DO35M. This section of SC&D contained the Production Measurement and Reporting Section of the SC&D System. It contains those functions related to management data processes (Department of the Air Force, 1987: 2-6).

Maintenance System Inputs. There are a myriad of systems that make up the tracking and scheduling systems for depot level maintenance activity. According to Sylvester Cleveland, Maintenance Systems Analyst at Head Quarters Air Force Materiel Command, during a 5 March 1994 interview, the two main systems needed for asset visibility in the Depot Maintenance System are the Depot Maintenance Management Information System (DMMIS) and the Distribution and Repair in Variable Environments Support System (DRIVE).

DMMIS. The Depot Maintenance Management Information System, when completely functional, will replace 41 existing systems. DMMIS will improve scheduling and maintenance workloads, provide better use of worker's skills and ensure that the right parts are on hand at the right time for depot repair and maintenance (Financial, 1992: 62-66).

DO41. The Recoverable Consumption Item Requirements System is a data system designed to support the requirements determination function. It computes world-wide requirements for recoverable assets and provides inputs to DRIVE (AFMC, 1994: 100).

DRIVE. The Distribution and Repair in Variable Environments Support System will collect and preprocess data from interfacing systems. This information if used by DRIVE for computing repair and distribution requirements as well as shipment priorities (AFMC, 1994: 152).

CAMS. The Core Automated Maintenance System is responsible for the base level tracking of aircraft status, repair action, parts status and job status. In a TAV system with base level or intermediate repair facilities, CAMS or a similar system would be necessary. For this thesis, a two-level maintenance repair system is used, and base level maintenance systems will not be required.

Transportation System Inputs. Transportation is a vital link in the TAV system. Ships, railcars, tractor trailers, and aircraft need to be thought of as warehouses and inventory in motion. According to Greg Holevar, Team Coordinator, Combat Readiness and Resources, Headquarters Air Force Materiel Command, during a 11 March 1994 interview, the systems that need to be included in a TAV system are: the Enhanced Transportation Automated Data System (ETADS), the Consolidated Aerial Port Subsystems-II (CAPS-II), the Cargo Movement Operations System (CMOS), and the commercial industry's cargo tracking records.

ETADS. The Enhanced Transportation Automated Data System is a composite system that integrated several antiquated transportation systems in the late 1980s. ETADS provides positive control of transportation funds, and worldwide Air Force asset movement, control and visibility. ETADS is the combination of two subsystems. The Overseas Cargo Movement (OCM), and the Transportation Financial Management (TFM). The OCM subsystem is responsible for clearing cargo through Air Mobility Command (AMC) channels via the Air Force Shipper Service Control Office (SSCO). The SSCO is the sole responsible agent for challenging air eligibility for the Air Force. The SSCO also provide cargo tracing services, and notification of explosive and escort cargo to world-wide Aerial Port of Embarkations (APOES). The TFM subsystem controls obligation and validation of expenditures for Air Force transportation funds. The TFM subsystem is also responsible for budget preparation and the forecasting of cargo movement by Military Sealift Command (MSC) and Air Mobility Command (AMC) (Smith, 1992).

CAPS II. The Consolidated Aerial Port Subsystems II provides AMC aerial ports the ability to process cargo coming into a base via surface or air and leaving the base via surface or air. The system also provides the user with the ability to manage all 10 files required for the various aspects of cargo processing. Included in these files are: (1) the functions to get cargo accepted by AMC for movement by air, (2) the capability to process transportation control and movement documents (TCMDs), (3) provide load planning personnel with the capability to select cargo for missions, create mission header records, build pallets, enter air manifest data, and incheck cargo, (4) provide truck dock personnel the capability to select cargo for outbound surface movement and automatically generate manifest numbers and references, and (5) provides the user with the capability to verify TCMD data as cargo arriving via surface enters the port (Modern Technologies, 1992: 1-3).

CMOS. The Cargo Movement Operations System (CMOS) is a three tiered system that will allow the entire Air Force transportation community to fight a contingency using the same processes and procedures used in peace. When totally operational the CMOS system will: (1) provide the major segment of the Air Force's compliance with Defense Guidance mandated Transportation Coordinator-Automated Information Management System (TCAIMS), (2) expand the use of Logistics Marking and Reading Symbol (LOGMARS) capability, (3) introduce electronic data interchange (EDI) at base level, (4) provide a major capability necessary to achieve in-transit visibility, and (5) be the primary source of information critical to war-time command and control (U.S. Department of Transportation, 1989: 1). According to Janie L. Smith, Transportation Systems Analyst, Headquarters, Air Force Materiel Command, in a 7 April 1994 interview, CMOS has two of the three tiers implemented, and the system runs successfully at over 15 Air Force bases. The first tier implemented the automated traffic management functions, while the second tier implemented various transportation mobility functions.

Commercial Carrier Data. For total visibility in the Air Force transportation system, the Air Force must have visibility of its cargo moving within the commercial sector.

The Air Force receives tracking data from a very small percentage of the air and surface carriers it uses. Capturing this data will be essential to In-transit Visibility (ITV), which is a critical factor in TAV (Holevar, 1994).

Global Transportation Network (GTN). GTN is a system developed by the USTRANSCOM. This system provides component commands with integrated automated support to plan, provide, and control commercial and military airlift, surface lift, and terminal services to deploy and sustain forces on a global basis in peace and at war. GTN's aim is to use existing government and commercial systems, integrate these into a single database, and provide DOD wide ITV (Computer Sciences Corporation, 1993: 1-1).

Several of the above systems provide overlapping information within the SC&D system. These systems may be used for tracking of assets within supply, transportation, maintenance and acquisition. For example, the two systems from acquisition needed for TAV visibility are also listed within the supply systems. Much of the information needed in the development of a TAV system is already closely related, and in some cases inter-related. Many of the transportation systems have been united in forming the GTN system, providing ITV for the DOD. ITV is only one part of the TAV formula. Various efforts are underway by different DOD agencies in the pursuit of TAV. The Air Force has two main systems that may become the TAV cornerstone. The Army is also working on the development of a TAV system that will provide asset visibility from factory to foxhole (Roos, 1994: 29).

Current Visibility Systems

There are currently three systems that are possibilities in becoming the DOD's TAV system. The Army's effort is called the Total Distribution Advanced Technology Demonstration System. A second effort is the Navy developed, Air Force adopted, Reparable Pipeline Visibility System. The final system, currently used for asset tracking throughout the Air Force is the Air Force Logistics Information File.

Total Distribution Advanced Technology Demonstration (TDATD) System. The TDATD system is the Army's effort at developing a TAV system. The system shows potential for tracking supplies aboard aircraft and ships, as well as redirecting material to forces on the move. The system shows advantages at the strategic, operational and tactical levels. The strategic advantages are found in its graphic representations of status and locations of deploying units and material, anticipated times and ports of embarkation, and the expected times of arrival in the theater of operations. Operational features include locations of shipments between the US and their destinations, plus the range of available ports and airfields. The tactical advantages of the TDATD are its ability to access digitized map displays of battlefields. The TDATD can depict the locations of critical supply points, support units, actual and projected consumption rates, along with information on the status of supply and choke points (Roos, 1994, 29). The TDATD is still a developmental system, but shows the Army's commitment to getting TAV as a warfighting tool.

Reparable Pipeline Visibility (RPV). The Joint Logistics Systems Center (JLSC) tasked the Fleet Material Support Office (FMSO) to deploy existing technology to provide RPV to the Air Force. RPV is an application of TAV, with the purpose of supporting Air Force Logistics Plans like Two-Level Maintenance and Lean Logistics. RPV's goal is to track a reparable's progres from removal, through transportation to the depot for maintenance, through maintenance, and into supply. Additionally, items will be tracked from requisition to receipt at base (Department of the Air Force, 1994: 3).

> The objective of RPV is to provide timely and accurate visibility of all assets in the logistics pipeline, to measure their progress through the pipeline against time standards, and to display and report on line data. The goal is to measure a continuous pipeline as each unique item moves through each segment. Since present data systems do not provide any single data element which links all processes, RPV must recognize discontinuous items. In those instances, RPV will gather data for each discrete pipeline segment which is available. The Program Manager (PGM) will provide a method of capture, display, and print dispersed data to facilitate asset tracking and pipeline measurement. In

> addition, there is a requirement to gather repair history in order to cleanse the pipeline of assets which fail repeatedly or which test out serviceable at the depot. RPV will not require the creation of new Air Force data structures or asset visibility systems. RPV will be developed to use data which will be provided by any evolving or future Air Force systems. (Department of the Air Force, 1994: 3)

According to the statement of work, RPV will use existing systems to build a framework for a TAV system. See Figures 1 and 2 for a detailed analysis of the data sources and available data RPV incorporates to provide TAV.

Air Force Logistics Information File (AFLIF). While RPV is taking normal military system channels to be developed, introduced, approved and accepted by the Air Force, AFLIF was developed out of an urgent necessity by a dedicated staff at Headquarters Air Force Material Command. AFLIF was developed to meet the need for visibility of Desert Shield materiel throughout the logistics pipeline. AFLIF satisfied the need of portraying both Supply and Transportation status with one query, on a single screen, and accessed this data by multiple parameters (HQ AFLC, 1991: 5).

> AFLIF captures supply activity every fifteen minutes, and airlift/sealift movement information every hour. The system matches the supply and transportation records to portray all activity related to a customer's requirement. Air Force shipments can be traced by requisition number, transportation control number (TCN) or by national stock number (NSN). AFLIF can also identify consolidations (multiple requisitions moving in one box under a lead TCN) and provide the movement information under the lead TCN. The user can identify all requisitions moving in the container by query of the TCN.

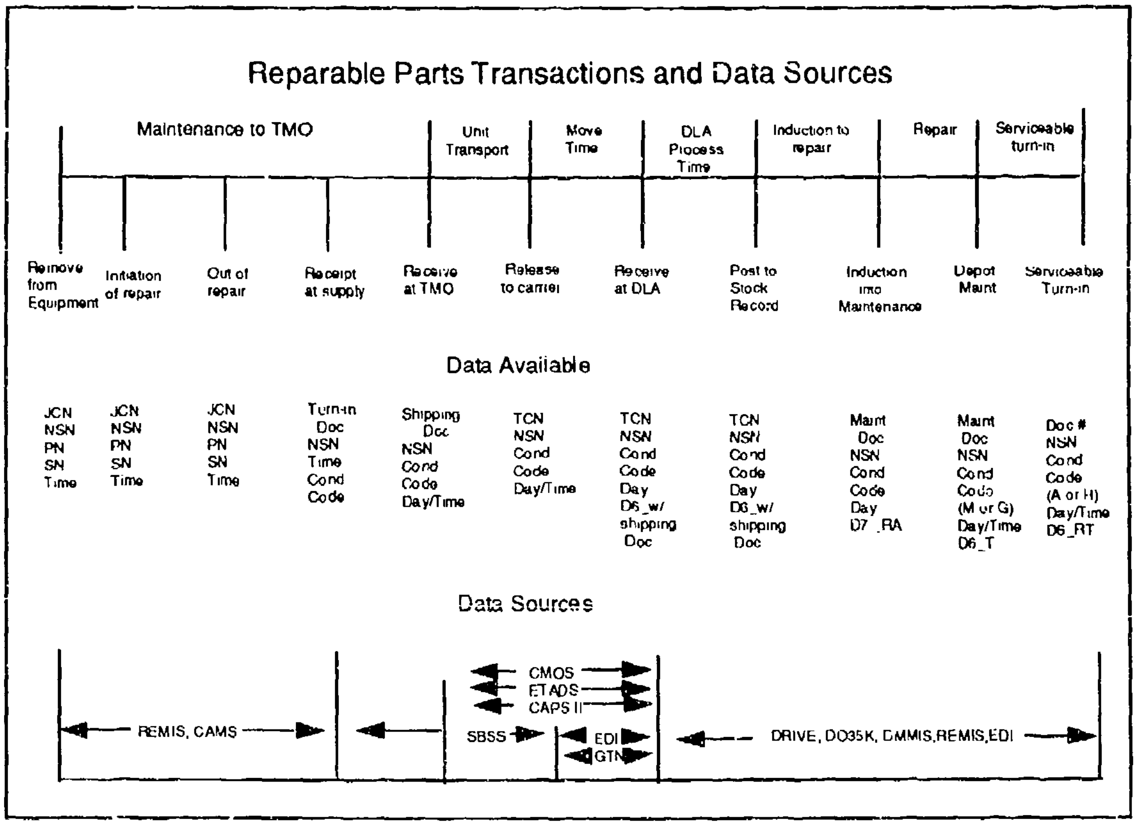

Figure 1. Reparable Parts Transactions and Data Sources (Department of the Air Force, 1994: 14).

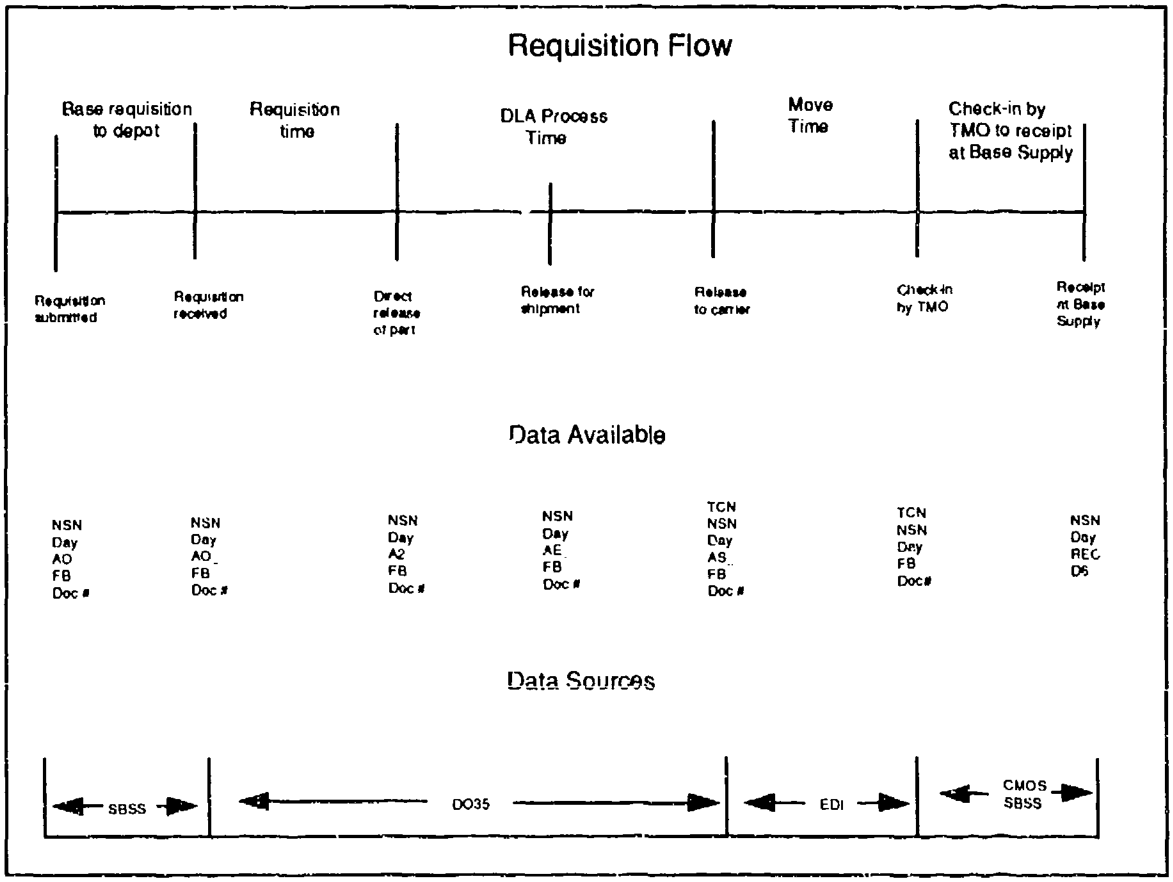

Figure 2. Requisition Flow
(Department of the Air Force, 1994: 15).

> Additionally, a query of the stock number will allow the customer to see supply/transportation status of all requisitions or TCN's ordered, enroute or recently received, by base, or for all accounts in-theater. (HQ AFLC, 1991: 5)

HQ AFMC/LGT has added more options to the AFLIF system in order to push it closer to the TAV system the Air Force needs. The menu driven, user friendly system was critical in helping to alleviate cargo saturation loads at the ports during Desert Shield/Storm.

The Air Force uses a multitude of systems in the support of its logistics pipeline. Each logistic concentration has its own subset of systems it uses to perform its critical function. Technological advances have made asset visibility a reality in the civilian transportation sector, and will be a war fighting tool for the logistician in future conflicts. The Air Force realizes it has a multitude of systems that must interact and share information. RPV and AFLIF are examples of the Air Force's commitment to making TAV a reality in the near future.

Chapter Summary

American industry is changing the way it does business. Firms are reexamining their strategies in order to successfully compete in today's marketplace. The customer service strategy is one area being examined as a way to compete. Firms are trying to find ways to improve their customer service and reduce costs at the same time. The firms' logistics systems are the primary areas being exploited to make the changes that will improve customer service and reduce costs. To implement this new strategy, firms use the power of the computer. Bar-coding and EDI are two ways that firms are using computer technology to compete more effectively. Many firms compete with information to improve their position in the marketplace. The firms taking advantage of the information systems available are successfully competing in today's marketplace.

The Air Force can learn some valuable lessons from private industry. The Air Force needs to improve the performance of its logistics system in these times of diminishing budgets. Looking at the success private industry has enjoyed by exploiting computer technology to improve the performance of logistics systems, the Air Force should consider incorporating the same principles. Greater use of bar-coding and EDI to improve inventory status, and development of an information system that gives the accurate location and status of a shipment, could improve the effectiveness of the Air Force logistics system. Knowing the exact location of all the assets in the system would result in lower overall costs and higher productivity (Kettner, Wheatley and Peterson, 1992: 219).

The Air Force can meet its goal of improving its logistics system by incorporating the strategies that are currently used by private industry. These strategies include employing information technology to the logistics system and examining a customer from a systems perspective. The development of the Air Force TAV system, combining the tools of the corporate world with the Air Force's special requirements, is critical to meeting the needs of the future.

The next chapter provides the specific methodology for this research effort.

III. Research Methodology

Chapter Overview

The objective of this research is two-fold. First, the authors developed a theoretical centralized control agency that would control the logistics support for the B-1B. The resulting Logistics Control Facility (LCF) with its Total Asset Visibility (TAV) system is then tested using simulation. The purpose of the simulation is to determine what impact, if any, the conceptual model has on the ability of the Air Force logistics system to support the B-1B. Three items are required to meet the second research objective.

First, an inventory model that captured the dynamic nature of aircraft component failures is required. RAND's Dyna-METRIC model was chosen for this research. Using information about aircraft usage, component characteristics, and demand for logistics resources, Dyna-METRIC assesses the effects of wartime dynamics, produces operational performance measures, and identifies potential problems (Isaacson and Boren, 1993: iii).

Second, a realistic scenario and database are needed to model the performance of the B-1B under anticipated conditions peculiar to the weapon system. Using projected flying hours for fiscal year 1995 in conjunction with projected possessed aircraft for three B-1B bases, a peacetime scenario is employed. Spares data obtained from Dynamics Research Corporation were prepared for input into RAND's most current reparable inventory model.

Third, an experimental design that would answer the investigative question is required. Initially, the current maintenance support configuration for the B-1B is modeled to use as the base case. Then, the experimental design investigates supporting the selected LRUs under a two-level maintenance concept with dedicated trucking as the primary transportation mode. Next, overnight carriers are used in place of dedicated trucking to determine if transportation would impact aircraft readiness rates under a TAV system. Continuing, a buffer stock is added to the scenario at selected locations to determine its impact on aircraft readiness. Dedicated trucking and overnight carriers are considered separately with the buffer stock scenario. Finally, an intermediate repair facility is added to the scenario to determine its impact on aircraft readiness. All of the above scenarios assume that an LCF is in place with a TAV system.

Control Facility with Total Asset Visibility

The Logistics Control Facility uses the information available from a TAV system for the efficient and effective control of assets throughout the logistics pipeline. The information available within the TAV system is from existing acquisition, maintenance, supply and transportation systems.

The LCF has the authority to effect mode, priority, and destination on asset shipments. With this information the LCF will be able to satisfy the most urgent needs of the B-1B weapon system, leaving more routine needs for a later time. The original concept for the LCF was developed by Greg Holevar, Team Coordinator, Combat Readiness and Resources, Headquarters Air Force Materiel Command (AFMC), Wright-Patterson Air Force Base.

The literature review of this thesis provided a general overview of the current Air Force systems necessary to provide asset visibility for the LCF. It also described the success that industry is having using asset visibility systems. The Literature Review also provided three systems currently working in the Department of Defense in the asset visibility environment. These systems provided important information supporting the near reality of a TAV system in the Air Force. TAV is the base system the LCF uses to be a proactive decision making unit, supporting the logistical needs of the B-1B weapon system. The remainder of the concept for the structure of the LCF used in this thesis came from background interviews with experts in the area of asset visibility.

Information was added to the conceptual development of the LCF by William Stringer, a Strategic Planner with the Dynamics Research Corporation in Dayton Ohio. William Stringer is a retired Air Force Colonel with an extensive background in supply and logistics. Andrew Figueroa, Chief, Combat Readiness and Resources, also was a key figure in the development of an LCF model. Andrew Figueroa was critical to the success of the Logistics Airlift (LOGAIR) System, and instrumental in the development of AFLIF. He also was the force in AFLIF being used by Air Force personnel to track cargo throughout the world. In addition, system analysts from transportation, supply, maintenance and acquisition provided inputs on the systems necessary for the LCF to have the proper visibility. Transportation system inputs were provided by Janie L. Smith, a Transportation Systems Analyst, Greg Holevar and Andrew Figueroa. They provided the information on AFLIF, CMOS, ETADS, CAPSII, and the necessary commercial transportation data needs. SMSgt Morgan, Supply Systems Analyst, provided the supply system inputs for the SBSS and SC&D systems. Sylvester Cleveland, Maintenance Systems Analyst and George Zeck, Item Repair Determination Analyst, provided the inputs for the DMMIS, DO41, DRIVE, CAMS, DO35A, DO35K and G402A maintenance and acquisition systems. These interviews combined with the original concept helped to create the final LCF model used for this thesis. This methodology provides the basis for answering the first four investigative questions.

Evaluation Model

Dyna-METRIC is a standard assessment tool within the Air Force. Dyna-METRIC Version 4 is incorporated into the AFMC's Weapon System Management Information System (WSMIS).

WSMIS is a tool used by logisticians to assess combat capability for war planning purposes (Isaacson and Boren, 1993: 1).

Dyna-METRIC assesses the effects of wartime dynamics, produces operational performance measures, and identifies potential problems by using information about planned aircraft usage, aircraft component characteristics, and the component's demand for logistic resources (Isaacson and Boren, 1993: iii). Dyna-METRIC Version 6 is a capability assessment model expressly suited to analyzing the effects of supply, maintenance, and transportation on aircraft availability. Version 6 incorporates a more fully developed representation of the repair process and its constraints than earlier model versions. Structurally, Version 6 is similar to earlier versions, but the analytical calculations of probabilities have been replaced by Monte Carlo sampling (Isaacson and Boren, 1993: v).

Representing Uncertainty. Uncertainty exists for almost everything in the military environment. The demand process for aircraft components is always uncertain. The mean failure rate and the variation about the mean both change over time. There will always be more removals than expected for some components and fewer than expected for other components. Version 6 models uncertainty in logistics by considering component demand variation, repair capacity constraints, and information lags (Isaacson and Boren, 1993: 2).

Capabilities. Dyna-Metric Version 6 provides various measures of performance for specified days of analysis given a description of the aircraft, flying program and the logistics system. Measures of performance include the status of components in different pipeline segments, such as number in work, backorders, and number in transit (Isaacson and Boren, 1993: 4). A problem parts report helps the logistician determine causes of performance shortfalls. The performance shortfalls include poor component reliability, ineffective transportation, limited spares, and slow or inadequate repair capabilities. The problem parts report indicates where the flow is constrained in the pipeline (Isaacson and Boren, 1993: 4).

Limitations. Though superior to the earlier analytic versions of Dyna-METRIC, Version 6 does have some limitations. First, it does not have the capability to compute spares requirements. The equations that compute spares requirements to achieve specified goals in the analytic model are unavailable in the simulation. Also, the run time is longer for the simulation than the analytic model. Run time is a linear function of the number of bases, components, trials, and time horizon (Isaacson and Boren, 1993: 4). These limitations must be considered before proceeding with the experiment.

Model Assumptions (Isaacson and Boren, 1993)

1. Individual component removals are independent such that removal of one component has no effect on removal of others. This assumes other parts are not damaged when a component is removed, and when a new part is installed all other parts work.

2. The pipeline quantity has a Poisson distribution with a mean equal to the average failure rate times average repair time.

3. All LRU cannibalizations are considered to happen instantaneously. In reality, there would be delays due to maintenance actions and management decisions. Obviously, it takes time to remove an LRU from one aircraft and place it into another aircraft. Also, the decision to take the cannibalization action sometimes is delayed while management waits for status on an order for a replacement part.

4. Sortie rate is not constrained by factors such as weather, manning, or other human interaction. These variables are currently beyond the modeling capability of Dyna-METRIC Version 6. In reality, these variables would have an effect on sortie rates.

5. All aircraft are available at the start of the simulation.

Research Database

The line replaceable units selected for this study were taken from the B-1B Readiness Spares Package (RSP) potential candidate list developed by Air Combat Command (ACC). Dynamics Research Corporation simulated a two week deployment with nine B-1Bs using the RSP candidate list as the deployed support package. The resulting potential problem list of 43 LRUs was selected as the database for this study. The logic behind using these LRUs as the research database is that if they are going to be potential problems for a two week deployment, then they will also be potential problems for normal peacetime operations (Stringer, 1994).

Dynamics Research Corporation provided information about the LRUs on the potential problems list. Included in the information were demand rates, Not Repairable This Station (NRTS) rates, quantity per aircraft, repair cycle times, and authorized quantities. Sources for the data were the DO41 and DO43A systems. The DO41 system, the Recoverable Consumption Item Requirements System, is used to compute world-wide requirements for reparable items. The DO43A system, the Master Item Identification Control System, is the master cataloging system for the Air Force (Stringer, 1994). Of the original 43 potential problem LRUs, 20 were finally used for the model. The reason for only using 20 LRUs was due to a limitation with Dyna-METRIC Version 6. The model was only able to simulate one depot location, and the 43 LRUs were repaired at four different depots. As a result, the 20 LRUs that were repaired at Oklahoma City Air Logistics Center were used as inputs to the model.

Other sources of information were obtained through conversations with personnel from Yellow Freight System, Incorporated, HQ AFMC and HQ ACC. Information provided by these sources included transportation times between bases and depots, average sortie duration, and assigned aircraft.

Scenario

The scenario developed for this study is based on the projected fiscal year 1995 flying hour program for the B-1B. Three bases, Ellsworth AFB, Dyess AFB, and McConnell AFB, were used in the model. Only three were used since they are the only projected bases to be flying the B-1B in 1995 (Stringer, 1994). The scenario duration is 90 days with each base employing an average sortie duration of 4.5 hours.

Experimental Design

The objective of the experimental design in this study is to determine the best maintenance support configuration for the B-1B under the control of a centralized agency with a TAV system in place. Initially, the current maintenance support configuration is modeled as the base case. Next, the current configuration is modeled with a TAV system in use to determine if the TAV system would provide system improvement. Only the portions of the conceptual model are tested. Specifically, the ability of the Logistics Control Facility with a TAV system in place to reduce administrative delays at the bases and the depots is tested. The ability to move assets between bases before orders are placed or to divert assets in-transit is not modeled because Dyna-METRIC Version 6 is not capable of providing these options.

After determining that an LCF with TAV provides system improvement for the current maintenance support configuration for the B-1B, several different configurations of the maintenance support structure with an LCF and TAV are modeled by changing transportation modes, buffer stock locations, and intermediate repair facility locations. Table 1 provides a complete overview of the experimental design.

Factors. There are five factors in the experimental design. They are LCF with TAV, maintenance level, centralized intermediate repair facility (CIRF), transportation method, and buffer stocks.

There are two levels for the LCF with TAV factor. For the first treatment this factor is not used, but for the remaining treatments, it is always used.

The maintenance level is set at three for the first two treatments which examine the current support configuration for the B-1B. In other words, the traditional three-level maintenance concept is modeled. For the remaining treatments, the maintenance level is set at two, representing the new two-level maintenance concept.

TABLE 1

EXPERIMENTAL DESIGN

TREAT	LCF w/TAV	MAINT. LEVEL	CIRF (Y/N) [LOCATION]	TRANS. METHOD	BUFFER STOCK (LOCATION)
1	N	III	N/A	CURRENT	N/A
2	Y	III	N/A	CURRENT	N/A
3	Y	II	N	DED. TRUCK	N
4	Y	II	N	FED. EX.	N
5	Y	II	N	DED. TRUCK	Y (EAFB)
6	Y	II	N	DED. TRUCK	Y (MAFB)
7	Y	II	N	DED. TRUCK	Y (DAFB)
8	Y	II	N	FED. EX.	Y (EAFB)
9	Y	II	N	FED. EX.	Y (MAFB)
10	Y	II	N	FED. EX.	Y (DAFB)
11	Y	II	Y [EAFB]	DED. TRUCK	N
12	Y	II	Y [MAFB]	DED. TRUCK	N
13	Y	II	Y [DAFB]	DED. TRUCK	N
14	Y	II	Y [EAFB]	FED. EX.	N
15	Y	II	Y [MAFB]	FED. EX.	N
16	Y	II	Y [DAFB]	FED. EX.	N

The centralized intermediate repair facility factor has three levels when it is used. Each level corresponds to a different location for the centralized intermediate repair facility. Treatments 11-16 employ this factor.

The transportation method factor also has three levels. The first level, labeled "CURRENT" in Table 1, uses the transportation times from D041 system which are a combination of surface and air transportation times. The second level, labeled "DED. TRUCK" in Table 1, uses the transportation times when a dedicated surface freight carrier is employed to provide transportation services. The third level, labeled "FED. EX." in Table 1, uses the transportation times when Federal Express is employed to provide transportation services.

The last factor, buffer stocks, is used in a manner similar to the centralized intermediate repair facility factor. When it is used, it has three levels which correspond to different locations for the buffer stock. Treatments 5-10 employ a buffer stock.

Model Input Parameters

This section provides a description of the input parameters required for the model (Isaacson and Boren, 1993: 10-11). In addition, an explanation of the origins of the data for each input parameter is provided.

Scenario Data

1. *Aircraft level specification*: This specifies the number of aircraft at each base. Aircraft levels at each

base are set at projected fiscal 1995 primary aircraft authorizations (Dulong, 1994). For this scenario, Ellsworth AFB has 30 aircraft, Dyess AFB has 32 aircraft, and McConnell AFB has 10 aircraft. The numbers remain unchanged throughout the 90-day scenario.

2. *Sortie rate specification*: The flying program at each base is specified in terms of average number of sorties per aircraft per day. The flying program is based on the projected fiscal year 1995 flying hour program for the B-1B. The sortie rates for Ellsworth AFB and Dyess AFB are set at 0.4 sorties per aircraft per day. The sortie rate at McConnell AFB is set at 0.3 sorties per aircraft per day. These rates remain the same throughout the 90-day scenario.

3. *Maximum sortie rate specification*: This specifies the maximum number of sorties an available aircraft can fly per day at each base. Starting at day one and continuing through the 90-day scenario, a rate of one sortie per day is used as the maximum sortie rate. This was based on the fiscal year 1995 programmed flying hours and conversations with Air Combat Command headquarters personnel (Dulong, 1994).

4. *Flying hour per sortie specification*: This specifies how many flying hours are required per sortie. For this scenario, an average sortie duration of 4.5 hours is used. This figure is used because it is the current planning figure used by Air Combat Command (Dulong, 1994).

Location Descriptions

1. *Base description records*: These describe the availability of resupply and repair at a base. They also provide the transportation times to and from intermediate repair facilities. Three bases are used in the scenario representing Ellsworth, McConnell, and Dyess AFBs.

2. *Centralized Intermediate Repair Facility (CIRF) description records*: These describe the availability of resupply and repair at each CIRF. CIRFs are used as a variable in the experimental design. When the CIRF is an input to the model, it was located at three different bases to determine the best location for a CIRF. Information for these records was obtained from Dynamics Research Corporation.

3. *Depot description records*: These describe the availability of repair and resupply at the depots. Oklahoma City Air Logistics Center is modeled with resupply and repair capability available at day one of the scenario.

4. *Depot transportation records*: These describe the transportation times between the bases and the depots and the CIRFs and the depots. This is also a variable in the experimental design. Transportation between bases is modeled using either dedicated trucking or Federal Express service. The transportation times used were based on conversations with AFMC/LGTX personnel (Holevar, 1994) and Yellow Freight System personnel (Benvenuto, 1994).

Administrative Data

1. *TOP records*: These specify general information about the each run such as number of trials, random number seeds, and days of analysis. They also specify administrative delay times at each echelon and the distribution policies at the CIRFs and depots. The inputs for administrative delays are based on a TAV system being in place under the control of a centralized control agency.

2. *Option records*: These specify the model options which generate the output reports. Options selected are 8 (Problem LRU Report), 11 (Performance Report), 15 (Pipeline Report). Also option 25 is selected which allowed for the lateral supply of LRUs.

Component Data

1. *LRU records*: These records provide information about each LRUs failure, repair, and resupply characteristics. Characteristics include level of repair, quantity per aircraft, demand rate, and resupply times. Also for each echelon of repair, repair times, NRTS rates, and condemnation rates are specified. The information for these records was provided by Dynamics Research Corporation.

2. *Application records*: These records specify the proportion of aircraft on which the LRU is installed at each base. For this scenario the application fraction is set to one since all of the aircraft at each base are identical.

3. *Variance-to-mean ratio (VTMR) records*: These records specify each LRU's VTMR, a standard measure in logistics models that expresses the uncertainty of estimated demand rates. For this scenario the VTMR for each LRU is set to one which implies a pipeline with a Poisson distribution of demands.

Verification and Validation

Verification and validation of the model is important and must be addressed prior to assessing the results of the study. Specifically, does Version 6 provide proper model results? Secondly, do the results obtained represent realistic capability assessments of the B-1B?

Verification. The mathematics of Dyna-METRIC Version 6 has yet to have a documented verification by the Air Force. However, previous versions of Dyna-METRIC have been validated by the Air Force. Version 3.04 has been verified and documented by the Air Force Logistics Management Agency (Stone and Wright, 1984: 67). As well, Version 4 has been adopted by the Air Force as a standard assessment tool. It has been integrated into the WSMIS to produce assessments of stock support (Isaacson and Boren, 1993: 1). However, since no Air Force studies have been completed on the verification of Version 6, this study is limited by the assumption that Version 6 provides proper model results.

Validation. Although Version 6 has yet to be validated by the Air Force, previous versions of RAND's Dyna-METRIC models have been validated. The first validation of Dyna-METRIC (Version 3.04) took place at Nellis AFB, NV at a Tactical Air Command (TAC) Leading Edge exercise (Stone and Wright, 1984: 67). Dyna-METRIC Version 4.4 was validated in 1987 for the F-15 during a Coronet Warrior exercise at Langley AFB, Virginia. Using the actual demand rates for the exercise as inputs to the model, Version 4.4 produced reliable results. At the conclusion of the exercise, 17 aircraft were fully mission capable, whereas the model predicted 16 aircraft would be fully mission capable (Haney, 1988: 45).

In addition, several studies have been done using earlier versions of the Dyna-METRIC model to include simulating strategic airlift (Stone and Wright, 1984), supply support for MC-130s and AC-130s (Brennan, 1986), supply support for tactical radar units (Mabe and Ormston, 1984), and an analysis of C-17 war readiness spares kits (Haney, 1988). All of these studies produced valid results using the previous versions of Dyna-METRIC.

A copy of the input data file for treatment 1 was sent to RAND in April 1994 for validation purposes. Karen Isaacson, one of the developers of Dyna-METRIC Version 6, ran the file to validate the output from the simulation. In an electronic mail message, Ms. Isaacson stated, "the output for the input file provided is consistent with similar input data used at RAND." (Isaacson, 1994).

HQ AFMC has yet to validate the latest version of Dyna-METRIC, Version 6. In effect, this will be the first Air Force study to use Dyna-METRIC Version 6 (Niklas, 1994). RAND Corporation provided a sample analysis of 30 avionics components of the F-16 aircraft to provide the user some intuition about the workings of the model (Isaacson and Boren, 1993: 19), but to date no Air Force studies to validate the model have been conducted. Consequently, since there has been no external validation of the model, this study is limited by the assumption that Version 6 realistically represents B-1B capabilities.

Statistical Analysis

Two measures of performance are used to assess the capabilities of the different treatments in the experimental design. The first performance measure is expected fully mission capable (FMC) rates for the entire B-1B fleet. The second performance measure is the total number of assets in all segments of the pipeline. These performance measures are used in the analysis of the experimental design.

The output from each treatment in the experimental design is collected and analyzed using basic statistical techniques. The first technique utilized is the two-sample *t* test. After completion of the simulation runs for the first two treatments, a two-sample *t* test is performed to determine if the means between the two treatments are statistically different. The purpose of the *t* test is to determine if the employment of the LCF with a TAV system provides any system improvement for the current support structure for the B-1B. This analysis provides the basis for answering Investigative Question Five which is to determine what impact, if any, an LCF with TAV has on the current support structure for the B-1B.

To answer Investigative Question Six, an analysis of variance (ANOVA) for a randomized block design is used to determine if the means differ between treatments for each performance measure. The theory behind the randomized block design is that the sampling variability of the experimental units in each block is reduced, in turn reducing the measure of error. By employing blocks of experimental units, error variability is reduced, thereby making the test for comparing the means more powerful (McClave and Benson, 1991: 892).

An ANOVA is used to compare the average expected mission capable rates for each treatment. For this randomized block design, the bases are considered to be the blocks. Denoting the population mean of each treatment as μ_i, where i = 1 to 16, then the hypothesis for the experiment is:

H_o: $\mu_1 = \mu_2 = \mu_3 \ldots = \mu_{16}$

H_a: The mean FMC rates differ for at least two treatments.

If the *F* test results in the rejection of the null hypothesis, then the Least Significant Difference (LSD) method of comparing the means will be employed. The LSD method is the most powerful comparison method and controls the comparisonwise error rate at α, which is set at 0.05 for this test (Statistix, 1992: 204).

The second performance measure is also analyzed using a randomized block design. An ANOVA is used to compare the average number of assets in the pipeline for each treatment. For this randomized block design, the LRUs are treated as the blocks. Denoting the population mean of each treatment as μ_i, where i = 1 to 16, then the hypothesis for the experiment is:

H_0: $\mu_1 = \mu_2 = \mu_3 \ldots = \mu_{16}$

H_a: The mean asset count in the pipeline differs for at least two treatments.

If the F test results in the rejection of the null hypothesis, then the LSD method of comparing the means is employed.

The results of these two ANOVAs are used to answer the last investigative question which is to determine what is the optimal support configuration for the B-1B assuming that an LCF with TAV is in place.

Assumptions. Two assumptions are necessary to assure the validity of each test. First, the probability distributions for each treatment-base and treatment-LRU combination are normal. Second, the variances of the probability distributions for each treatment-base and treatment-LRU combination are identical (McClave and Benson, 1991: 891).

Chapter Summary

This chapter provided the research methodology to answer the investigative questions in Chapter I. The development of the conceptual model is presented, and the experimental design for testing portions of the conceptual model is introduced. Finally, a plan for analyzing the data is described. The next chapter describes the data analysis of the experimental design. The statistical techniques used to analyze the output data are presented.

IV. Data Analysis

Chapter Overview

This chapter outlines the steps used to organize the output data from the simulation runs into a useful form in order to answer the investigative questions proposed in Chapter I. The statistical techniques used to analyze the output data are presented. The techniques used include two-sample *t* tests and analysis of variance.

Analysis

The two performance measures, expected FMC rate and expected pipeline quantity, are used to analyze the results of the experimental design.

Performance Measure One. The first performance measure used to determine the effectiveness of the LCF with a TAV system was expected FMC rate. The first step in the process was to simulate the current logistics support system for the B-1B as it stands today. Treatment 1 represented this support configuration. Then, the same logistics support system was simulated with an LCF controlling the movement of assets through the pipeline aided by a TAV system. Treatment 2 represented this support configuration.

Two-Sample t Test. After the simulation runs were complete for the two treatments, a two-sample *t* test was performed to determine if there was a statistically significant difference between the two treatments for expected FMC rate. The results are shown in Table 2. The *t* test labeled EQUAL VARIANCES tests the null hypothesis that the means for the two treatments are equal given that the two treatments have the same variances. As can be seen from the test, there is a statistically significant difference between the two treatments at nearly a 96 percent confidence level. The *F* test for equality of variances supports the assumption that variances are equal (p-value = 0.1655).

TABLE 2

TWO-SAMPLE *t* TEST FOR EXPECTED FMC RATES

TWO-SAMPLE T TESTS FOR EXPECTED FMC RATES BY TREATMENT

Treatment	Mean	S.D.	S.E.
1	98.000	0.2228	0.1114
2	98.617	0.4168	0.2084

	T	DF	p-value
EQUAL VARIANCES	-2.61	6	**0.0401**
UNEQUAL VARIANCES	-2.61	4.6	0.0519

	F	NUM DF	DEN DF	p-value
TESTS FOR EQUALITY OF VARIANCES	3.50	3	3	**0.1655**

CASES INCLUDED 8 MISSING CASES 0

The next step in the process was to determine what logistics support configuration, utilizing an LCF with TAV, would provide the best support for the B-1B. The different configurations were simulated using Dyna-METRIC Version 6 as the simulation platform. The expected FMC rates for the different treatments are shown in Table 3.

TABLE 3

EXPECTED FMC RATES

TREATMENT	EXPECTED FMC RATE	STANDARD DEV.
1	98.000	0.2227
2	98.617	0.4167
3	97.325	0.3675
4	99.266	0.2357
5	96.783	0.8434
6	97.216	0.7852
7	96.850	0.8850
8	99.358	0.0567
9	99.300	0.2802
10	99.308	0.2347
11	96.608	1.3910
12	96.883	0.8297
13	97.316	0.4255
14	99.033	0.4721
15	99.291	0.2544
16	99.133	0.3474

It is important to note here that the expected FMC rates are computed for the 20 LRUs used in the simulation model, not the aircraft as a whole.

ANOVA. An ANOVA was performed for a randomized block design on these values to determine if there were any statistically significant differences between the means. The treatments were used as the main effects and the bases were used as the blocks. The results of the ANOVA are shown in Table 4.

TABLE 4

ANOVA FOR EXPECTED FMC RATES

ANALYSIS OF VARIANCE TABLE FOR EXPECTED FMC RATES

SOURCE	DF	SS	MS	F	p-value
TREATMENT (A)	15	73.7862	4.91908	29.01	**0.0000**
BASE (B)	3	9.99505	3.33168	19.65	**0.0000**
A*B	45	7.63133	0.16958		
TOTAL	63	91.4126			
GRAND AVERAGE	1	6.165E+05			

The results of the ANOVA indicate that the expected FMC rates differ significantly between the treatments. The p-value of 0.0000 for the treatments is highly significant. In addition, the p-value of 0.0000 for the blocks confirms that FMC rates at the bases vary significantly and the use of the block design was a good decision. The next step in the process was to do a comparison of the means to determine which treatments were significantly different from one another. The LSD method was used for comparing the means. The results of the comparison of the means are shown in Table 5.

TABLE 5

COMPARISON OF MEANS FOR EXPECTED FMC RATES

LSD(T) PAIRWISE COMPARISONS OF MEANS OF EXP. FMC BY TREAT

TREATMENT	MEAN	HOMOGENEOUS GROUPS
8	99.358	I
10	99.308	I
9	99.300	I
15	99.291	I
4	99.266	I
16	99.133	I I
14	99.033	I I
2	98.616	.. I
1	98.000	 I
3	97.325	 I
13	97.316	 I
6	97.216	 I
12	96.883	...... I I
7	96.850	...... I I
5	96.783	...... I I
11	96.608	 I

THERE ARE 5 GROUPS IN WHICH THE MEANS ARE
NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.

CRITICAL T VALUE	2.014
REJECTION LEVEL	0.050
CRITICAL VALUE FOR COMPARISON	0.5864
STANDARD ERROR FOR COMPARISON	0.2911

ERROR TERM USED: TREATMENT*BASE, 45 DF

The first feature about Table 5 that should be noted is that treatment 1 and treatment 2 are in two different homogeneous groups. Treatment 1 is the simulation of the current system in place today, and treatment 2 is the simulation of the current system with an LCF in place controlling the movement of the assets through the pipeline. The only change between the two simulations is the ability of the LCF, aided by a TAV system, to reduce administrative delays in the pipeline. The capability of the LCF to divert assets already in the forward pipeline or move assets between bases prior to an actual need is not modeled due to limitations with Dyna-METRIC Version 6.

As Table 5 shows, there are five homogeneous groups in which the means for the treatments in a group are not significantly different from one another. Eight of the treatments are significantly better, in terms of expected FMC rates, than the current system, which was modeled as treatment one. Seven of the treatments are significantly worse, in terms of expected FMC rates, than the current system. There is one factor that proved to be common among the treatments that are better and the treatments that are worse than the current system. That one factor is the mode of transportation.

The mode of transportation used in seven of the eight treatments that proved to be significantly better is Federal Express. The other treatment that is significantly better, treatment 2, is the current system with an LCF controlling the logistics pipeline. The mode of transportation used in the seven treatments that proved to be worse was dedicated carrier. The number of days travel time required to move parts between the depot and bases using the dedicated carrier averaged three days. The number of travel days for Federal Express was only one day.

The other factors used in the experimental design, the use of buffer stocks at different locations and the use of centralized intermediate repair facilities at different locations, do not appear to be significant factors for the expected FMC rate performance measure. For instance, in the first homogeneous group shown in Table 5, there is only one factor that is common among the different treatments. That factor is the use of Federal Express as the mode of transportation. Treatments 8-10 employ a buffer stock at various locations. Treatments 14-16 employ a centralized intermediate repair facility at various locations. Treatment 4 is pure two-level maintenance. However, all the treatments in that group do use Federal Express as the mode of transportation.

Performance Measure Two. The other performance measure used to determine the effectiveness of the LCF with a TAV system is the expected pipeline quantity.

Two-Sample *t* Test. After the simulation runs were complete for the first two treatments, a two-sample *t* test was performed to determine if there was a statistically significant difference between the two treatments for expected pipeline quantities. The expected pipeline quantities are for the twenty LRUs used as inputs to the simulation. As a reminder, treatment 1 is the current logistics support system for the B-1B, and treatment 2 is the current support system with an LCF controlling the movement of assets through the pipeline. The results of the *t* test are shown in Table 6.

TABLE 6

TWO-SAMPLE *t* TEST FOR EXPECTED PIPELINE QUANTITIES

TWO-SAMPLE T TESTS FOR EXPECTED PIPELINE QTY BY TREAT

TREAT	MEAN	S.D.	S.E.
1	1.5416	1.6782	0.3752
2	1.2700	1.4711	0.3289

	T	DF	p-value
EQUAL VARIANCES	0.54	38	0.5894
UNEQUAL VARIANCES	0.54	37.4	0.5894

	F	NUM DF	DEN DF	p-value
TESTS FOR EQUALITY OF VARIANCES	1.30	19	19	0.2857

CASES INCLUDED 40   MISSING CASES 0

The *t* test labeled EQUAL VARIANCES tests the null hypothesis that the means for the two treatments are equal given that the two treatments have the same variances. As can be seen from the test, the null hypothesis is not rejected. There is no significant difference in the expected pipeline quantities for the two treatments. The *F* test for equality of variances supports the assumption that variances are equal (p-value=0.2857).

TABLE 7

EXPECTED PIPELINE QUANTITIES

TREATMENT	EXPECTED PIPELINE	STANDARD DEV.
1	1.5416	1.6782
2	1.27	1.4711
3	1.3283	1.2683
4	1.2033	1.2126
5	1.4716	1.4785
6	1.4666	1.4597
7	1.4666	1.4510
8	1.3216	1.3612
9	1.3133	1.3544
10	1.3166	1.3524
11	1.7783	2.0399
12	1.8	2.1466
13	1.795	1.7950
14	1.4816	1.7930
15	1.5133	1.7699
16	1.5416	1.9086

The remaining 14 treatments are then simulated using Dyna-METRIC Version 6, and measurements are taken to determine the expected number of assets in the pipeline at any moment in time for the twenty LRUs modeled. The expected number of assets in the pipeline for the different treatments is shown in Table 7.

ANOVA. An ANOVA was performed for a randomized block design on the expected pipeline quantities to determine if there were any statistically significant differences between the means. The treatments were used as the main effects and the LRUs were used as the blocks. The results of the ANOVA are shown in Table 8.

TABLE 8

ANOVA FOR EXPECTED PIPELINE QUANTITIES

ANALYSIS OF VARIANCE TABLE FOR EXPECTED PIPELINE QUANTITY

SOURCE	DF	SS	MS	F	p-value
TREAT (A)	15	10.4527	0.69685	3.41	0.0000
LRU (B)	19	760.926	40.0487	196.22	0.0000
A*B	285	58.1683	0.20409		
TOTAL	319	829.547			
GRAND AVERAGE	1	696.790			

The results of the ANOVA indicate that the expected pipeline quantities differ significantly between the treatments. The p-value of 0.0000 for the treatments is highly significant. In addition, the p-value of 0.0000 for the blocks confirms that the pipeline quantity of each LRU varies significantly and the use of the block design was a good decision. The next step in the process was to do a comparison of the means to determine which treatments were significantly different from one another. The LSD method was used for comparing the means. The results of the comparison of the means is shown in Table 9.

TABLE 9

COMPARISON OF MEANS FOR EXPECTED PIPELINE QUANTITIES

LSD(T) PAIRWISE COMPARISONS OF MEANS OF EXP. PIPE BY TREAT

TREAT	MEAN	HOMOGENEOUS GROUPS
12	1.8000	I
13	1.7950	I
11	1.7783	I I
1	1.5416	I I I
16	1.5416	I I I
15	1.5133	.. I I
14	1.4816	.... I I
5	1.4716	.... I I
7	1.4666	.... I I
6	1.4666	.... I I
3	1.3283	.... I I
8	1.3216	.... I I
10	1.3166	.... I I
9	1.3133	.... I I
2	1.2700	.... I I
4	1.2033	 I

THERE ARE 4 GROUPS IN WHICH THE MEANS ARE
NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.

CRITICAL T VALUE	1.968
REJECTION LEVEL	0.050
CRITICAL VALUE FOR COMPARISON	0.2812
STANDARD ERROR FOR COMPARISON	0.1428

ERROR TERM USED: TREAT*LRULST4, 285 DF

As Table 9 indicates, there are four homogeneous groups in which the means for the treatments in a group are not significantly different from one another. There is only one treatment that is statistically significantly different from the current system, which is modeled as treatment 1. The one treatment that is different, treatment 4, is the pure two-level maintenance configuration using Federal Express as the transportation mode. This treatment has statistically fewer assets in the pipeline than the current system has in the pipeline at any moment in time.

One other aspect of Table 9 that is readily evident is that the use of a centralized intermediate repair facility (CIRF) results in the most assets being tied up in the pipeline. The first homogeneous group, the group with the highest means, contains five treatments. Four of the five treatments use a CIRF, treatments 11-13 and 16. The other common factor in this group is the use of a dedicated carrier as the transportation mode. Treatments 11-13 use a dedicated carrier for mode of transportation. Treatment 16 uses Federal Express as the mode of transportation, but the location of the CIRF in this treatment may have been a factor. The location of the CIRF in treatment 16 is McConnell AFB.

On the other hand, the last homogeneous group in Table 9, the group with the lowest means, has only one treatment in it that employs a CIRF. Treatment 14 uses a CIRF at Ellsworth AFB with Federal Express as the transportation mode. None of the other treatments in this group employed a centralized intermediate repair facility.

Chapter Summary

This chapter outlines the process used to organize the output data from the simulation runs into a useful form in order to answer the investigative questions proposed in Chapter I. The statistical techniques used to analyze the output data from the simulation model are presented in both tabular and narrative form. The techniques used include two-sample *t* tests and analysis of variance. In the next chapter, the findings are discussed. Each investigative question is restated and answered using the analysis from this chapter and the literature review as support. Finally, recommendations for further research are presented.

V. Conclusions

Chapter Overview

This chapter answers the investigative questions presented in Chapter I. Each investigative question is restated and discussed based on the information obtained from the research methodology. The organizational structure of the LCF and the components of the TAV system as conceptualized by the authors is also provided. Last, recommendations for further research as a result of this thesis are provided.

Investigative Question One

How are computers and information systems used by U.S. industry for competitive advantage?

This question was answered by performing a literature review on the topic.

Information technology significantly impacts the operations in the service and manufacturing industries. The growth and capabilities of information technology are tremendously impacting the methods in which business is conducted. United States industry is employing information systems for competitive advantage in a number of ways. The two most prevalent currently are the use of electronic data interchange and bar coding.

Electronic Data Interchange. Electronic data interchange (EDI) is a key element in a number of firms for improving inventory management. Transactions handled by EDI include purchase orders, invoices, and bills of lading. EDI facilitates improvements in inventory management by eliminating many of the problems associated with traditional information processing systems. Problems such as backlog, data re-entry, and timeliness are eliminated by EDI, and entry errors are minimized because EDI requires only a single data input.

EDI provides other benefits to the users as well. Among these benefits are reduced inventory levels, reduced order processing times, reduced order processing costs, and increased customer satisfaction. While purchasing and transportation have been the beginning points for EDI in most organizations, other applications exist for EDI. Applying EDI in areas such as scheduling and production control offers organizations even greater benefits than those experienced today. To stay competitive in today's marketplace, organizations are relying on EDI.

Bar Coding. Bar coding is also a cornerstone in a number of firms in their efforts to improve inventory management. The ultimate goal of bar coding is to provide accurate information about inventory as it moves through the pipeline. Bar coding helps the logistics manager get the right inventory to the right place at the right time by reducing picking and shipping errors, helping to ensure orders are filled correctly. Fewer shipping errors lead to fewer unsatisfied customers.

Bar code technology has grown rapidly over the past few years and should continue to improve. The benefits of bar coding at the warehouse include improved data collection accuracy, reduced receiving operations time and data collection labor, and data collection integration with other areas. The benefits of bar coding on the retail side include the ability to closely monitor sales and maintaining greater control over inventory levels.

One other characteristic of bar coding that is becoming increasingly important in today's marketplace is the ability to provide complete visibility of a shipment for a customer. Many carriers today use bar coding to ensure correct and accurate shipment movement data is available for the customer. Each firm is able to determine shipment location at anytime, in a terminal, in a truck, or in the air.

Investigative Question Two

What information systems are currently in use by the Air Force?

This question was answered by performing a review of the current literature on the topic, and through interviews with Air Force personnel at Headquarters Air Force Materiel Command.

The development of a TAV system to support the logistic needs of the U.S. Air Force is underway. However, senior defense officials are pushing to create a DOD-wide TAV system. Not yet willing to turn over TAV entirely to the DOD effort, the Air Force is still pursuing the creation of a service-wide TAV. Due to the monumental task of uniting the logistic system from each service, the Air Force's individual efforts are showing considerable success and are slightly ahead of the joint projects (Holevar, 1994).

One success in a visibility systems available to Air Force users at a DOD level is United States Transportation Command's (USTRANSCOM) Global Transportation Network (GTN). This joint transportation system is nearing the completion of a series of system enhancements, and as of the date of this thesis is partially mission capable (Holevar, 1994). GTN provides the Air Force and other DOD agencies in-transit visibility (ITV) of assets and passengers as they travel through the logistic pipeline. This is a key factor in the needs for a TAV system.

While USTRANSCOM finishes the development of a DOD-wide ITV, several efforts are providing partial TAV to Air Force users. AFLIF, the Air Force Logistics Information File, developed during Desert Shield/Storm, has been operating as a partial TAV system since 1990. AFLIF provides base and depot level supply records as well as a large percentage of the transportation records for asset tracking. AFLIF does not contain the needed acquisition and maintenance records in order to provide a complete TAV. AFLIF is a credit to the exhaustive work by the logisticians at Headquarters Air Force Materiel Command during Desert Shield/Storm.

A second DOD-wide TAV effort available to Air Force users is the Reparable Pipeline Visibility (RPV) system. RPV, a Navy developed TAV system, contains similar records to those available in AFLIF. One advantage of RPV is that it contains some maintenance information not available in AFLIF. One disadvantage is that RPV is not currently as user friendly as AFLIF (Holevar, 1994). Regardless, RPV like AFLIF is providing partial visibility of assets in the pipeline.

AFLIF receives its information from the Defense Automated Addressing System Office (DAASO) in Dayton, Ohio. All supply and transportation records are sent through this office and are held by the AFLIF data base for near real-time visibility. The data within AFLIF is batched every 15 minutes (Holevar 1994). This means status information on supply and transportation is never older than 15 minutes. A secondary system has replicated this process to withdraw all DOD supply information. This system, the Logistics Information Processing System (LIPS) is also available to Air Force users for supply asset visibility.

GTN, AFLIF, RPV, and LIPS are currently available for use by Air Force logisticians. Each is a critical part of the TAV puzzle, but none of the systems as yet provide the complete TAV needed for the functioning of an LCF. Realizing the importance of further development of TAV, as of 14 June 1994, Senior Pentagon officials have given the task of developing DOD-wide TAV to the Joint Logistics Systems Center (JLSC). As stated above, there is a considerable risk in trying to develop the all-encompassing DOD TAV. Trying to tie so many systems, both inside and outside of individual service lines, could lead to long delays and cost overruns. However, due to the individual efforts of those who developed GTN, AFLIF, and RPV much of the groundwork has already been completed. JLSC can benefit customers by uniting the systems already available, adding the missing links, and making a user friendly system which logisticians can use to support front-line weapon systems.

Investigative Question Three

How can these information systems be used to provide a TAV system to the Air Force?

The Air Force has implemented several programs in order to reduce inventory levels and support infrastructure costs. The two-level maintenance concept is the most recognized of these efforts, and lean logistics is the latest effort to reduce support costs. However, in the conversations, briefings, and demonstrations on how these concepts are going to improve the Air Force logistics system, rarely does the topic of information systems come up. For these concepts to maximize their potential for reducing support costs, an adequate information system that can provide decision makers with real-time information needs to be in place (Stringer, 1994).

As in private industry, Air Force logistics managers need to become proactive, designing systems that meet customer needs. The logistics pipeline can no longer be used as a buffer for a poor performing logistics system. It simply costs too much. The logistics pipeline must be considered a single entity for faster, more flexible response to minimize throughput time and inventory costs. That's where computer technology comes into play. As mentioned earlier, computer technology enables the logistics organization to control information and change the traditional ways of supplying products (Stock, 1990: 134).

The technology exists today that would allow the Air Force to reap the same benefits as its private industry counterparts, a reduction in costs and improved customer service. The capability exists to provide the logistician with TAV, which can be defined as the capability of both operational and logistics managers to determine and act on timely and accurate information about the location, quantity, condition, movement, and status of Air Force assets (Department of the Air Force, 1993: 3).

Electronic Data Interchange (EDI). EDI is one tool that the Air Force logistician can employ in an effort to make a TAV system a reality. The current procedure for ordering a replacement part from a depot requires several forms to be filled out and then entered into the local supply information system. The requisition passes through several layers of administration before reaching the servicing depot. Once the request makes it to the depot, several hours to several days can elapse before the requester receives status on the order.

EDI would eliminate nearly all of these steps and speed up the process considerably (Stringer, 1994). Even with a batch process, the speed in which orders are processed would increase significantly. Lowering the order processing time in turn lowers the lead time, which in turn lowers safety stocks. Lower safety stocks means lower operating costs, which means the Air Force saves money. Lean logistics and two-level maintenance would be helped along immensely through an EDI order processing system.

Figure 3 shows where EDI could be used in the information flow of the pipeline. Orders are placed by units in the field to the depots through EDI, using procedures similar to those used by numerous organizations in the private sector. In turn, the depots provide the units with shipping notices and order status using EDI. The ability of EDI to reduce order processing costs has already been proven by private industry. There is no reason to think that the Air Force couldn't achieve similar cost reductions (Stringer, 1994). In addition, EDI speeds up the flow of information that is essential for both the managers in the field and at the depots to make the best decisions

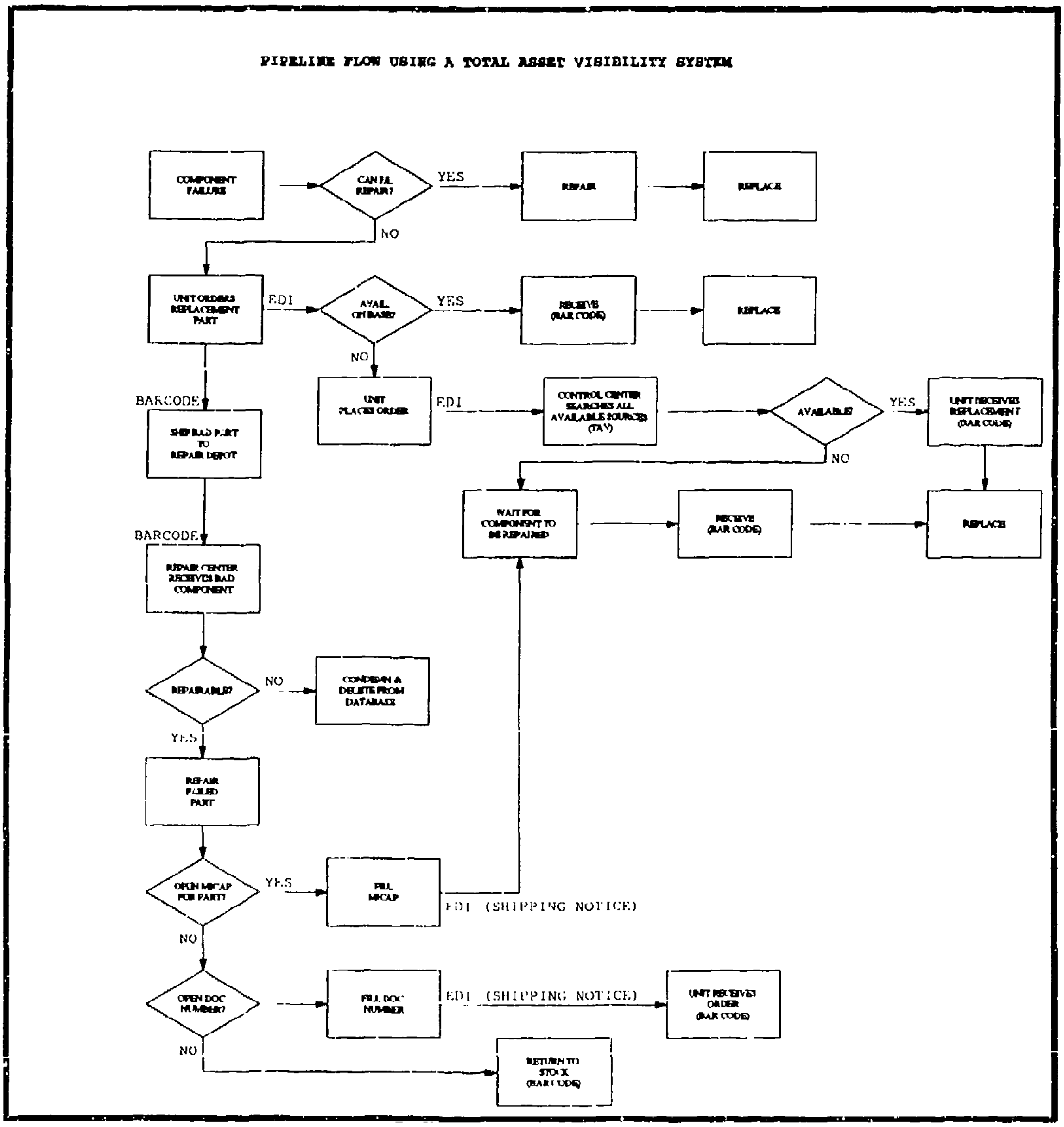

Figure 3. Pipeline Flow

possible. Accurate and timely information on inventory status is imperative to provide the customer with the best possible service.

<u>Bar Coding</u>. Bar coding could also aid immensely in providing better visibility of the assets in the system.

Every time an asset changes hands in the logistics pipeline, it could be bar coded to show its current location. The bar coded information would update a central computer system (a TAV system) that would provide decision makers with up-to-date and accurate information.

As Figure 3 illustrates, every time an asset moves from one function to another within the pipeline, it is bar coded to update its location within the pipeline. The procedure depicted in Figure 3 is similar to the procedures used by many of the express carriers such as Federal Express and United Parcel Service.

Through bar coding the logistics manager will have better information on the location of the assets in the pipeline, and better information leads to better decisions. With better control over the assets in the pipeline, the logic follows that fewer assets would be required to provide the same level of service (Stringer, 1994). Consequently, the Air Force can cut costs without degrading the readiness of the systems being supported.

TAV Application. The information systems described in the Literature Review as necessary for TAV in each logistical concentration will probably change in the future. The importance is not in the system names, but in the information they provide. AFLIF, is an excellent beginning system to explain the buildup of information necessary for the TAV.

AFLIF draws its information from data streams that flow into DAASO in Dayton OH. Example data provided in AFLIF include: date, time, pieces, weight, cube, priority, transportation control number, requisition number, national stock number, consignor, consignee, commodity and special handling code, required delivery date, and billing information. This incoming data provides AFLIF users the following supply and transportation information:

1. The requisition order from a base to a depot for a part,
2. The receipt of the requisition by the depot,
3. The backorder of the part (if not available) and substitute national stock number,
4. The release of the part from the depot to shipment planning,
5. The mode of transportation, carrier, date and time shipped,
6. The date and time of receipt at base transportation, and
7. The receipt at base supply. (Holevar, 1993)

In order to provide TAV to the Air Force, similar information needs to be available for maintenance and acquisition systems. When an aircraft is down for a part TAV would provide the necessary information for maintenance personnel to make better decisions in keeping aircraft in-commission. An example of the questions that would be answered for maintenance and acquisition would be: (1) Is the part available on base? (2) If not available on base, is one in transit, and what is the expected delivery time and date? (3) Is there a part available at another base or at depot? (4) If 1,2 and 3 above are negative, when will the next part come out of the depot repair line? (5) If the wait for a part from the depot maintenance line is too long, are there any newly procured assets coming into the inventory, and can one be direct shipped to fill the base maintainer's need?

This maintenance and acquisition information is available, and for too long has been information not to be shared outside of the Air Force Item Manager community. This information must be added to a system such as AFLIF or RPV to provide the TAV system the Air Force needs.

To give real-time power and speed to the TAV system, the EDI and bar coding techniques described above, need to be added to as many of the logistic stages as possible. Paper documentation for receipt and shipment need to be replaced by bar coding and EDI input. The combination of information from supply, transportation, maintenance and acquisition boosted with the power of EDI and bar coding will provide a TAV system that will support the logistical needs of the Air Force for years to come.

Investigative Question Four

How should a centralized control facility be organized to effectively and efficiently direct the activities of the Air Force logistics system?

In order for a Logistics Control Facility (LCF) to effectively and efficiently direct the activities of the Air Force's logistic system, it is assumed a fully mission capable TAV system is operational. The LCF's peacetime goal would be to increase or maintain aircraft readiness. In addition the LCF would save military budgets by lowering required inventory levels through the effective management of assets in the pipeline.

The construction of an Air Force-wide LCF was designed shortly after Desert Storm by Greg Holevar, Team Coordinator, Combat Readiness and Resources, Headquarters, Wright-Patterson Air Force Base. It was this original concept on which this thesis is based. This original concept was then molded by the authors to build the LCF needed for the support of the B-1B.

B-1B Logistics Control Facility. Due to the capabilities of current technology and the speed of the electron, the location of the LCF could be anywhere there are good telecommunication capabilities. It is probably best to keep the facility close to the major depot which does the majority of the maintenance. For the B-1B, the LCF would be at the Oklahoma City Air Logistics Center at Tinker AFB.

LCF Purpose. The purpose of the B-1B LCF is to work as a 24-hour per day information broker for the B-1B community. The LCF uses a TAV system to retrieve and disseminate information. The LCF is used both in peace and in war for asset tracking, priority adjustments, carrier and mode selection, and asset diversion for support of the B-1B weapon system. This thesis only deals with the peacetime operation of the LCF. In war the LCF would come under the appropriate Commander-in-Chief (CINC) of the contingency operation and would work to support the contingency through the direction of their CINC's needs (Holevar, 1993).

LCF Authority. One of the most difficult areas in construction of the LCF is who the LCF will answer to, and from whom do they get their authority. In reality an LCF will either belong to a Major Command, or work as a single service function. Due to parts being shared across many weapon systems, a realistic placement of the LCF would be within AFMC where its services could be shared among all weapon systems. For this thesis the LCF will be a single weapon system control facility, governing the actions of only the B-1B. The B-1B LCF will have constant communication with Ellsworth, McConnell and Dyess AFBs, as well as with the depots and key contractors of B-1B parts. How then will the authority be given to the LCF to make asset diversions, priority changes and other logistical maneuvers to support the most critical needs of the weapon system?

Without the proper authority, the LCF's decisions will be subject to questioning by the depot and bases. Therefore, the LCF must have its authority from the owning command of the weapon system. The B-1B LCF answers directly to, and get its authority from the major command senior logistics officer. The B-1B LCF's authority would come from the Air Combat Command's (ACC) Director of Logistics (LG). This authority is critical because the decisions of the LCF need to be followed by the bases, supporting depot and contractors. An asset diversion, taking a routine LRU destined for McConnell AFB and diverting it to fill a new priority need at Dyess AFB, could bring questions from the base whose asset is diverted. An aircraft hole would be created at McConnell AFB from the diversion, but the bases must realize the LCF is using the power of total asset visibility to fill the most urgent needs of the weapon system.

Personnel Structure. The personnel makeup of the LCF for the B-1B contains a mix of military and government civilians.

Military. The senior position would be the commander of the LCF. This would be a Colonel position. The LCF commander is responsible for the overall command of the LCF, and is responsible to the ACC/LG in the support of the B-1B. The Commander is also responsible for communications between base level LG's, DLA, and TAV system operations personnel. In addition to the Colonel there are three additional officer positions. A Lieutenant Colonel or Major position would be the Director of LCF Operations. This position is responsible for the day-to-day operations of the LCF. Beneath this position are two Captain slots. These officers fill positions as shift supervisors for LCF operations.

The enlisted personnel within the LCF fill a variety of positions. Each enlisted member is a critical member of the

LCF. Three senior Non-Commissioned Officers (NCO) act as Assistant Shift Supervisors. The third shift NCO is the senior individual on shift. In addition to the three senior NCOs, there are nine enlisted personnel between the grade of E-4 and E-6 to run the TAV systems. Each shift uses three personnel. Each shift should have an individual familiar with the systems and operations of transportation, supply and maintenance. These personnel use the information in the TAV system to perform a variety of functions.

<u>Civilian</u>. The civilian positions in the LCF are important. The military positions must be supported with the continuity of a government civilian position. The civilians are critical to training of the military personnel as they rotate through the LCF.

A GM-14 position works as the civilian equivalent to the Lieutenant Colonel/Major position as LCF Director of Operations. In addition, three GS-12 positions are the equivalent of the shift supervisors. Finally, three GS-10 positions are assigned to work with the lower grade enlisted personnel for the actual operation of the TAV system and interaction with the field.

<u>Experience Levels</u>. In total, the facility requires 23 personnel to provide the B-1B the support it requires. The background of each person is not as important as the mix of the team's background. Within the structure of the LCF personnel, there must be people with extensive maintenance knowledge on the weapon system being supported.

Also critically important are personnel with knowledge of depot maintenance operations, base level maintenance operations, supply systems and operations, (base and depot level), transportation systems and operations, acquisition systems, and the TAV system used to operate the LCF.

Operations. There are a considerable number of operations in which the LCF is active. The following two scenarios will provide examples of how the LCF operates to support the B-1B weapon system.

Scenario One. Diversion of assets is a primary method in which the LCF supports the B-1B. In this scenario Dyess AFB has a routine priority LRU being sent to it from the depot at Tinker. McConnell AFB, which is in an exercise, has just had an aircraft grounded for parts. The maintenance personnel at McConnell AFB contact the LCF asking for assistance. The LCF looks within the TAV system and finds the status of the urgent LRU. Then, the LCF notifies the depot, or even the carrier if the part is already in-transit, to divert the asset, changing the destination from Dyess AFB to McConnell AFB. It is the function of the LCF to make use of the inventory in motion, and make the transient portion of the logistics pipeline a portable warehouse. Through careful monitoring of asset status in the pipeline, the LCF becomes a proactive force in supporting the readiness of the weapon system, while decreasing the need for assets in the pipeline.

Scenario Two. In this scenario there is an urgent need for a scarce LRU at Ellsworth AFB. Ellsworth contacts the LCF for assistance in finding the closest LRU and getting it to them. The LCF operators use the TAV system available to do a data search to check the status of the LRU. First, the LCF checks transportation systems to see if any assets are in-transit and can be diverted to Ellsworth. Finding none, the LCF searches the base level quantities at other B-1B bases hoping to laterally support Ellsworth. Again the LCF is unsuccessful and looks into the depot level stock to check availability. They again are unsuccessful and look into the depot maintenance lines to see when the next LRU is scheduled to be released. Finding an unsatisfactory response, the LCF will check to see if there are any newly procured assets coming into the system. They are successful in their search and contact the item manager to have the contractor direct ship one of the LRUs to Ellsworth. This scenario shows the methodology with which the LCF operates.

A key factor in these scenarios is that the LCF can interact at all levels along the logistics pipeline to best support the weapon system. The LCF, in a sense, performs a logistical triage for the weapon systems it supports (Figueroa, 1993). A secondary, but equally important factor is the LCF provided constant information to the logisticians in the field, especially the maintainers. The information available to the LCF will frequently help the maintainer on the flight line decide whether to cannibalize an aircraft or not. This knowledge also reduces the uncertainty that causes base level maintenance to double order a part on a second tail number.

The key tasks that the LCF performs are asset diversion, asset search and status, carrier and mode change, and an overall watch of the logistic operation of the B-1B. For this thesis, the 23 person LCF was constructed to perform these functions for the B-1B; other structures could be used. One suggestion is to have one LCF for fighters, an LCF for bombers, an LCF for cargo aircraft, an LCF for missiles and so on. This will depend on the size of the LCF, and how much work each one can handle. The 23 person facility constructed above may be enough to handle all bombers in the inventory, while in the fighter world an LCF may be necessary for each specific weapon system. The critical point is that TAV is a tool, but without a centralized agency using that tool with the authority to change events in the logistics process, it is a tool with little function. Information is great. The ability to do something with that information is power.

Investigative Question Five

What effect does a TAV system employed by a centralized control agency have on the ability of the current Air Force logistics system to support weapon systems?

This question was answered by employing Dyna-METRIC Version 6 to model the logistics pipeline for the B-1B weapon system. First, the system as it exists today was simulated, and then the same system controlled by an LCF with a TAV system in place was simulated. Two performance measures, expected FMC rates and expected pipeline quantities, were used to determine the effectiveness of a TAV system when employed by an LCF.

Performance Measure One. Statistical analysis revealed a significant improvement in system performance for the expected FMC rate performance measure when an LCF with TAV controlled the movement of assets in the pipeline. The results of the *t* test, as shown in Table 2, are significant with a p-value of 0.0401.

The results of this test lead to the conclusion that an LCF, using a TAV system, controlling the movement of assets through the pipeline can significantly improve the expected FMC rates. The only change between the two treatments is the ability of the LCF, aided by a TAV system, to reduce administrative delays in the pipeline. The capability of the LCF to divert assets already in the forward pipeline or move assets between bases prior to an actual need are not modeled due to limitations with Dyna-METRIC Version 6. It can be assumed that these capabilities would only enhance the results that were obtained. The robustness of this finding leads the authors to believe that an LCF with a TAV system would significantly improve expected FMC rates for the B-1B weapon system without any changes to the support structure currently in place.

Performance Measure Two. Statistical analysis revealed no significant improvement for the expected pipeline quantity performance measure when an LCF with TAV controlled the movement of assets in the pipeline. As indicated in Table 6, the *t* test fails to reject the null that the two treatment means are equal. There is no significant difference in the expected pipeline quantities for the two treatments.

The results of this test lead to the conclusion that an LCF, using a TAV system, controlling the movement of assets through the pipeline would not change the expected pipeline quantities for the twenty LRUs used in the model.

Summarizing, a TAV system utilized by an LCF yields statistically significant improvements for expected FMC rates for the current B-1B support configuration. It does not yield statistically significant improvements for expected pipeline quantities for the current B-1B support configuration. The authors conclude that if an LCF with TAV were in place today, the B-1B community could expect to see improved FMC rates, but the number of assets tied up in the pipeline would not improve.

Investigative Question Six

With a TAV system in use by a centralized control agency, what is the optimal configuration for the Air Force logistics system?

This question is answered by employing Dyna-METRIC Version 6 to model the logistics pipeline for different support configurations for the B-1B weapon system. Two performance measures, expected FMC rates and expected pipeline quantities, are used to determine the effectiveness of the logistics pipeline under the different support configurations.

Performance Measure One. ANOVA analysis revealed significant differences for the expected FMC rates between individual treatments. The p-value of 0.0000 for the treatments means is highly significant.

For this performance measure, the transportation mode appears to be the most significant factor. As Table 5 shows, there are five homogeneous groups in which the means for the treatments in a group are not significantly different from one another. Eight of the treatments are significantly better, in terms of expected FMC rates, than the current system, which was modeled as treatment one. Seven of the treatments are significantly worse, in terms of expected FMC rates, than the current system. There is one factor that proved to be common among the treatments that are better and the treatments that are worse than the current system. That one factor is the mode of transportation.

The fact the transportation mode is the only factor common among the two groups is significant. It was unexpected that such a small difference in the transportation time would result in such a significant difference in system performance. As a result of this finding, logisticians should carefully consider the mode of transportation used in any pipeline support configurations. From this observation, the authors conclude that the mode of transportation plays a more important role in expected FMC rates than the other factors used in the experimental design.

The other factors used in the experimental design, the use of buffer stocks at different locations and the use of centralized intermediate repair facilities at different locations, do not appear to be significant factors for the expected FMC rate performance measure. In the first homogeneous group in Table 5, treatments 8-10 employ a buffer stock at various locations and treatments 14-16 employ a CIRF at various locations. Treatment 4 is pure two-level maintenance. As mentioned earlier, the only common factors in this group are the use of Federal Express as the mode of transportation and an LCF controlling the movement of assets through the pipeline with a TAV system.

From these observations, the authors conclude that employing an LCF with a TAV system under a pure two-level maintenance system with Federal Express as the transportation mode would provide the best support in regard to expected FMC rates. There are two reasons for this conclusion. First, as the data analysis shows, the expected FMC rates for the B-1B improve under a support system configured in this manner. Secondly, although no cost/benefit analysis was performed, it seems logical that this configuration would be cheaper to employ than a system that employed buffer stocks or CIRFs.

Performance Measure Two. ANOVA analysis revealed significant differences for the expected FMC rates between individual treatments. The p-value of 0.0000 for the treatments means is highly significant.

One aspect of Table 9 that is readily evident is that the use of a centralized intermediate repair facility (CIRF) resulted in the most assets being tied up in the pipeline. The first homogeneous group in Table 9, the group with the highest means, contains five treatments. Four of the five treatments used a CIRF, treatments 11-13 and 16. The other common factor in this group was the use of a dedicated carrier as the transportation mode. Treatments 11-13 used a dedicated carrier for mode of transportation. Treatment 16 used Federal Express as the mode of transportation, but the location of the CIRF in this treatment may have been a factor.

The location of the CIRF in treatment 16 is McConnell AFB. The authors concluded that using a CIRF at McConnell AFB tied up more assets in the pipeline because it had fewer aircraft assigned there. The logic for this conclusion is as follows.

McConnell AFB is modeled as having 10 aircraft assigned, Ellsworth AFB having 30 aircraft, and Dyess AFB having 32 aircraft. Obviously, the bases that have more aircraft are going to generate more traffic in the pipeline. By employing a CIRF at a base with numerous aircraft, such as Dyess or Ellsworth AFBs, the transportation pipeline segment will not have as many assets in it because the transportation time will be less for the aggregate traffic. For instance, when employing the CIRF at Dyess AFB, only 40 aircraft worth of LRUs are trucked in from other bases while 32 aircraft worth of LRUs are on the same installation as the CIRF. On the other hand, when employing the CIRF at McConnell AFB, 62 aircraft worth of LRUs are trucked in from other bases while only 10 aircraft worth of LRUs are on the same installation as the CIRF.

The end result is that more LRUs are tied up in the transportation segment of the pipeline when a CIRF is employed at McConnell AFB. Consequently, if the Air Force plans on using a CIRF to support the B-1B, it should consider placing it at either Dyess or Ellsworth AFB if it wants to keep the number of assets in the pipeline as low as possible. The authors' opinion is that if a CIRF is used, it should be placed at Ellsworth AFB with Federal Express used for the transportation mode. The reasoning behind this view is that this configuration, which is modeled as treatment 14, is a member of the last homogeneous group in Table 9, the group with the lowest means.

None of the other treatments in the last group in Table 9 used a CIRF. This observation leads the authors to conclude that the use of CIRFs results in more assets being tied up in the pipeline. More assets tied up in the logistics pipeline results in fewer assets available for the user. In order to maintain minimum mission readiness rates, more assets are required in the system to make up for the backlogs throughout the pipeline. This goes against everything that the Air Force is trying to do with its logistics pipeline.

For performance measure two, there is only one treatment that is statistically significantly different from the current system, which was modeled as treatment 1. The one treatment that was different, treatment 4, was the pure two-level maintenance configuration, under the control of an LCF, using Federal Express as the transportation mode. This treatment had statistically fewer assets in the pipeline than the current system had in the pipeline at any moment in time.

The other factors used in the experimental design, the use of buffer stocks at different locations and the use of different modes of transportation, do not appear to be as important for the expected pipeline quantity performance measure as the use of a CIRF. Transportation mode was more important than buffer stocks, but it was not as important as the use of a CIRF.

Summarizing, the authors conclude that the optimal support configuration for the B-1B is two-level maintenance, Federal Express as the mode of transportation, and an LCF with TAV in place controlling the movement of assets through the pipeline. This support configuration yielded the best results in terms of expected FMC rates and expected pipeline quantities. The simulation results for this specific treatment produced an expected FMC rate that was in the highest group and an expected pipeline quantities that was in the lowest group.

Summary of Findings

After analyzing the data from the experimental design, the authors conclude that the use of an LCF, aided by a TAV system, significantly improves expected FMC rates for the B-1B. Other changes to the support configuration for the B-1B are not required to realize these improvements. Employing other changes to the support configuration would also bring improvements to the expected FMC rates for the B-1B. Specifically, employing a two-level maintenance concept and Federal Express as the transportation mode in addition to the LCF would bring improvements beyond what is experienced by just employing an LCF. Overall, the mode of transportation proved to be the most important factor in regard to expected FMC rates.

The use of an LCF with TAV did not improve the quantity of assets in the pipeline over what is experienced by the current support configuration. However, the combination of LCF with TAV, two-level maintenance, and Federal Express for mode of transportation proved to be significantly better than the current configuration. Overall, the use of a CIRF proved to be the most important factor in regard to expected pipeline quantities.

If the Air Force plans to make changes to the support configuration for the B-1B, serious consideration should be given to mode of transportation and the use of CIRFs. Finally, the findings here provide evidence that the use of an LCF with a TAV system can improve the performance of the logistics pipeline. While this research effort used the B-1B as the weapon system of interest, it is the authors' opinion that similar findings would be realized for other weapon systems in the Air Force inventory. However, further research is required to substantiate the findings in this thesis.

It was discovered near the completion of this research that senior defense officials have decided to give the development of TAV to the Joint Logistics Systems Center (JLSC). Early briefings of JLSC's TAV plans pointed in the direction of production of a DOD-wide TAV. While an admirable goal, the authors suggest a smaller TAV development may be more successful. By attempting a DOD-wide TAV, the number of systems attempting to be connected is enormous. The cost of failure will also be very high. It is suggested that perhaps a small team of logisticians and computer systems personnel could successfully implement a TAV system for an individual weapon system, for example the B-1B. With a limited number of bases flying the B-1B, the connections of systems are minimal, as in comparison to a DOD-wide TAV. Mistakes could be made at a small level; costs are minimal in comparison to a DOD-wide system; and once a successful TAV system is complete, additional weapon systems can be brought on line.

The other possible problem comes from the speed of technology improvements. If the normal procedure of acquisition is followed for securing a contractor to develop a DOD-wide TAV, there is a risk that by the time the contractor gets to the implementation stage, much of the technology in the original statement of work will be obsolete. This was one of the main stumbling blocks implementing the CMOS system.

Recommendations for Further Research

This thesis focused on the development of a conceptual model for an LCF with a TAV system. Portions of the conceptual model were modeled using Dyna-METRIC Version 6. Much has been learned from the research effort, but many questions have surfaced that require further study.

First, expand the number of LRUs used as inputs into the simulation. The current research showed statistically significant results for the 20 LRUs used as inputs for this study. The full readiness spares package being developed for the B-1B would be a good sample of LRUs to test under the same conditions as this research. The results of such a study would provide a better basis for the utility of an LCF with a TAV system.

Second, manipulation of the depot repair times could provide different results. The depot repair times, based on data from the D041 system, remained the same throughout the treatments. By using depot repair times that other weapon systems are experiencing under the two-level maintenance concept, different results might occur. Treatment 4 was run again using average depot repair times that the F-16 has experienced for items under the two-level maintenance concept. All other inputs remained the same. The resulting expected FMC rate was 99.82 and the expected pipeline quantity was 0.425. Both of these figures are considerably better than the results where the current depot repair times for the B-1B are used.

Third, test the concept of an LCF with a TAV system for a weapon system other than the B-1B. A weapon system that is deployed at bases both in the CONUS and overseas would be best. This research used the B-1B as the weapon system for study, which is only based at CONUS locations. A weapon system that is based at both CONUS and overseas locations would provide a better test of the capabilities of the LCF.

Fourth, use the concepts developed in this study but use a different simulation model that would allow the movement of assets between bases prior to an actual need or divert assets already in shipment. These capabilities of the conceptual model were not tested due to limitations of Dyna-METRIC Version 6. These capabilities are integral parts of the LCF and should be tested to determine their impact on the logistics system.

Lastly, the conceptual model of the LCF with a TAV system was developed without regard to cost. A cost/benefit analysis of the LCF concept should be performed as part of the overall analysis to determine whether or not the LCF concept should be implemented.

APPENDIX A: LINE REPLACEABLE UNITS USED IN EXPERIMENTAL DESIGN

NSN	NOMENCLATURE	WUC
1280-01-182-6304EK	DISPLAY, ELECTRONIC	73FBB
1660-01-212-6399	CONCENTRATOR, MSOGS	47BAA
4140-01-148-0459	FAN, VANE AXIAL	41ACA
5841-01-150-7527EK	TRANSMITTER, RADAR	73DCF
5841-01-150-7528EK	TRANSMITTER, RADAR	73DCJ
5985-01-152-4173EK	ANTENNA ASSEMBLY	73DCB
6605-01-252-9480	NAVIGATION UNIT, INERTIAL	73DAA
6605-01-254-6944	COMPUTER, NAVIGATION	73BGA
6610-01-147-7221	CONTROL DISPLAY UNIT	55AAA
6610-01-269-5437	COMPUTER, AIR DATA	73ADC
6610-01-307-6363	DISPLAY, ELECTRONIC	73BHC
6610-01-356-6949	TRANSMITTER, AOA	73ADA
6615-01-035-1092	CONTROLLER, LOGIC	52ABA
6615-01-036-3198	COMPUTER, SPOILER	14AHB
6615-01-216-4822	GYROSCOPE, RATE	73BGD
6615-01-271-9168	CONTROLLER, FLAP/SLAT	14HDA
6615-01-275-4675	ADAPTER, FLIGHT INST	52ACA
6615-01-276-8318	CONTROL, GYROSCOPE	14DAA
6615-01-282-8765	CONTROL, AFCS/TRIM	52AAA
6620-01-265-2887	SENSOR, OIL TEMPERATURE	23SLC

Appendix B: Input Data Files For Dyna-METRIC Version 6

```
TREATMENT 1  3LM/CURRENT SUPPORT STRUCTURE/NO TAV
1  6.4     7.0  Version 6.4                    10    1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025 10 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  8.5  8.5
BS02 DFHZ  8.5  8.5
BS03 DFHZ  8.5  8.5
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 1 0  1  1000.000090.00009  6.0  .16
1280011826304EK X          29.0     0.0 60.0 30.0
1660012126399   DFHZ 1 0  1  1000.000030.00003  5.0  .95
1660012126399   X          29.0     0.0 60.0 30.0
4140011480459   DFHZ 1 0  2  2000.000070.00007  6.0  .96
4140011480459   X          29.0     0.0 60.0 30.0
5841011507527EK  DFHZ 1 0  2  2000.000370.00037 26.0  .53
5841011507527EK X          45.0     0.0 60.0 30.0
5841011507528EK  DFHZ 1 0  2  2000.000150.00015 31.0  .63
5841011507528EK X          45.0     0.0 60.0 30.0
5985011524173EK  DFHZ 1 0  1  1000.000040.00004  6.0  .52
5985011524173EK X          30.0     0.0 60.0 30.0
6605012529480   DFHZ 1 0  1  1000.000330.00033  5.0  .47
6605012529480   X          30.0     0.0 60.0 30.0
```

```
6605012546944  DFHZ 1 0  1  1000.000230.00023 18.0 .46
6605012546944  X          8.0     0.0 60.0 30.0
6610011477221  DFHZ 1 0  1  1000.000150.00015  4.0 .18
6610011477221  X          8.0     0.0 60.0 30.0
6610012695437  DFHZ 1 0  2  2000.000130.00013  6.0 .47
6610012695437  X         29.0     0.0 60.0 30.0
6610013076363  DFHZ 1 0  2  2000.000200.00020  5.0 .39
6610013076363  X         29.0     0.0 60.0 30.0
6610013566949  DFHZ 1 0  6  6000.000130.00013  5.0 1.0
6610013566949  X         29.0     0.0 60.0 30.0
6615010351092  DFHZ 1 0  1  1000.000440.00044  9.0 .18
6615010351092  X          9.0     0.0 60.0 30.0
6615010363198  DFHZ 1 0  1  1000.000190.00019  5.0 .32
6615010363198  X         10.0     0.0 60.0 30.0
6615012164822  DFHZ 1 0  1  1000.000470.00047  1.0 1.0
6615012164822  X         32.0     0.0 60.0 30.0
6615012719168  DFHZ 1 0  1  1000.000200.00020  3.0 .45
6615012719168  X         11.0     0.0 60.0 30.0
6615012754675  DFHZ 1 0  2  2000.000080.00008  4.0 .31
6615012754675  X         29.0     0.0 60.0 30.0
6615012768318  DFHZ 1 0  2  2000.000210.00021  5.0 .49
6615012768318  X          7.0     0.0 60.0 30.0
6615012828765  DFHZ 1 0  1  1000.000150.00015  7.0 .39
6615012828765  X          4.0     0.0 60.0 30.0
6620012652887  DFHZ 1 0  1  1000.000490.00049  5.0 .27
6620012652887  X         29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
```

```
6605012529480     1.00 1.00 1.00
6605012546944     1.00 1.00 1.00
6610011477221     1.00 1.00 1.00
6610012695437     1.00 1.00 1.00
6610013076363     1.00 1.00 1.00
6610013566949     1.00 1.00 1.00
6615010351092     1.00 1.00 1.00
6615010363198     1.00 1.00 1.00
6615012164822     1.00 1.00 1.00
6615012719168     1.00 1.00 1.00
6615012754675     1.00 1.00 1.00
6615012768318     1.00 1.00 1.00
6615012828765     1.00 1.00 1.00
6620012652887     1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   3
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ  13
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   3
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   4
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   2
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   3
END
```

```
TREATMENT 2  3LM/CURRENT SUPPORT STRUCTURE/TAV
1  1.0      1.5  Version 6.4                            10     1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025 10 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  8.5  8.5
BS02 DFHZ  8.5  8.5
BS03 DFHZ  8.5  8.5
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 1 0  1  1000.000090.00009  6.0  .16
1280011826304EK X            29.0      0.0 60.0 30.0
1660012126399    DFHZ 1 0  1  1000.000030.00003  5.0  .95
1660012126399    X           29.0      0.0 60.0 30.0
4140011480459    DFHZ 1 0  2  2000.000070.00007  6.0  .96
4140011480459    X           29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 1 0  2  2000.000370.00037 26.0   .53
5841011507527EK X            45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 1 0  2  2000.000150.00015 31.0   .63
5841011507528EK X            45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 1 0  1  1000.000040.00004  6.0  .52
5985011524173EK X            30.0      0.0 60.0 30.0
6605012529480    DFHZ 1 0  1  1000.000330.00033  5.0  .47
6605012529480    X           30.0      0.0 60.0 30.0
6605012546944    DFHZ 1 0  1  1000.000230.00023 18.0  .46
6605012546944    X            8.0      0.0 60.0 30.0
6610011477221    DFHZ 1 0  1  1000.000150.00015  4.0  .18
```

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6610011477221  X          8.0    0.0 60.0 30.0
6610012695437  DFHZ 1 0  2  2000.000130.00013  6.0  .47
6610012695437  X          29.0    0.0 60.0 30.0
6610013076363  DFHZ 1 0  2  2000.000200.00020  5.0  .39
6610013076363  X          29.0    0.0 60.0 30.0
6610013566949  DFHZ 1 0  6  6000.000130.00013  5.0  1.0
6610013566949  X          29.0    0.0 60.0 30.0
6615010351092  DFHZ 1 0  1  1000.000440.00044  9.0  .18
6615010351092  X          9.0    0.0 60.0 30.0
6615010363198  DFHZ 1 0  1  1000.000190.00019  5.0  .32
6615010363198  X          10.0    0.0 60.0 30.0
6615012164822  DFHZ 1 0  1  1000.000470.00047  1.0  1.0
6615012164822  X          32.0    0.0 60.0 30.0
6615012719168  DFHZ 1 0  1  1000.000200.00020  3.0  .45
6615012719168  X          11.0    0.0 60.0 30.0
6615012754675  DFHZ 1 0  2  2000.000080.00008  4.0  .31
6615012754675  X          29.0    0.0 60.0 30.0
6615012768318  DFHZ 1 0  2  2000.000210.00021  5.0  .49
6615012768318  X          7.0    0.0 60.0 30.0
6615012828765  DFHZ 1 0  1  1000.000150.00015  7.0  .39
6615012828765  X          4.0    0.0 60.0 30.0
6620012652887  DFHZ 1 0  1  1000.000490.00049  5.0  .27
6620012652887  X          29.0    0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399  BS01 1.00 BS02 1.00 BS03 1.00
4140011480459  BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480  BS01 1.00 BS02 1.00 BS03 1.00
6605012546944  BS01 1.00 BS02 1.00 BS03 1.00
6610011477221  BS01 1.00 BS02 1.00 BS03 1.00
6610012695437  BS01 1.00 BS02 1.00 BS03 1.00
6610013076363  BS01 1.00 BS02 1.00 BS03 1.00
6610013566949  BS01 1.00 BS02 1.00 BS03 1.00
6615010351092  BS01 1.00 BS02 1.00 BS03 1.00
6615010363198  BS01 1.00 BS02 1.00 BS03 1.00
6615012164822  BS01 1.00 BS02 1.00 BS03 1.00
6615012719168  BS01 1.00 BS02 1.00 BS03 1.00
6615012754675  BS01 1.00 BS02 1.00 BS03 1.00
6615012768318  BS01 1.00 BS02 1.00 BS03 1.00
6615012828765  BS01 1.00 BS02 1.00 BS03 1.00
6620012652887  BS01 1.00 BS02 1.00 BS03 1.00
1280011826304EK   1.00 1.00 1.00
1660012126399    1.00 1.00 1.00
4140011480459    1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
6610012695437    1.00 1.00 1.00
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6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   3
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ  13
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   3
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   4
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   2
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   3
END
•
```

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TREATMENT 3   2LM/DEDICATED TRUCKING/NO IRF/ NO BUFFER STOCK
11  1.0      1.5  Version 6.4                              10     1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
   008 10
   011
   015  1
   020  1
   025  3 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009      1.0
1280011826304EK X            29.0      0.0 60.0 30.0
1660012126399    DFHZ 3 0  1  1000.000030.00003      1.0
1660012126399   X            29.0      0.0 60.0 30.0
4140011480459    DFHZ 3 0  2  2000.000070.00007      1.0
4140011480459   X            29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037      1.0
5841011507527EK X            45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015      1.0
5841011507528EK X            45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004     1.0
5985011524173EK X            30.0      0.0 60.0 30.0
6605012529480    DFHZ 3 0  1  1000.000330.00033      1.0
6605012529480   X            30.0      0.0 60.0 30.0
6605012546944    DFHZ 3 0  1  1000.000230.00023      1.0
6605012546944   X             8.0      0.0 60.0 30.0
6610011477221    DFHZ 3 0  1  1000.000150.00015      1.0
```

6610011477221 X 8.0 0.0 60.0 30.0
6610012695437 DFHZ 3 0 2 2000.000130.00013 1.0
6610012695437 X 29.0 0.0 60.0 30.0
6610013076363 DFHZ 3 0 2 2000.000200.00020 1.0
6610013076363 X 29.0 0.0 60.0 30.0
6610013566949 DFHZ 3 0 6 6000.000130.00013 1.0
6610013566949 X 29.0 0.0 60.0 30.0
6615010351092 DFHZ 3 0 1 1000.000440.00044 1.0
6615010351092 X 9.0 0.0 60.0 30.0
6615010363198 DFHZ 3 0 1 1000.000190.00019 1.0
6615010363198 X 10.0 0.0 60.0 30.0
6615012164822 DFHZ 3 0 1 1000.000470.00047 1.0
6615012164822 X 32.0 0.0 60.0 30.0
6615012719168 DFHZ 3 0 1 1000.000200.00020 1.0
6615012719168 X 11.0 0.0 60.0 30.0
6615012754675 DFHZ 3 0 2 2000.000080.00008 1.0
6615012754675 X 29.0 0.0 60.0 30.0
6615012768318 DFHZ 3 0 2 2000.000210.00021 1.0
6615012768318 X 7.0 0.0 60.0 30.0
6615012828765 DFHZ 3 0 1 1000.000150.00015 1.0
6615012828765 X 4.0 0.0 60.0 30.0
6620012652887 DFHZ 3 0 1 1000.000490.00049 1.0
6620012652887 X 29.0 0.0 60.0 30.0
APPL
1280011826304EK BS01 1.00 BS02 1.00 BS03 1.00
1660012126399 BS01 1.00 BS02 1.00 BS03 1.00
4140011480459 BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK BS01 1.00 BS02 1.00 BS03 1.00
6605012529480 BS01 1.00 BS02 1.00 BS03 1.00
6605012546944 BS01 1.00 BS02 1.00 BS03 1.00
6610011477221 BS01 1.00 BS02 1.00 BS03 1.00
6610012695437 BS01 1.00 BS02 1.00 BS03 1.00
6610013076363 BS01 1.00 BS02 1.00 BS03 1.00
6610013566949 BS01 1.00 BS02 1.00 BS03 1.00
6615010351092 BS01 1.00 BS02 1.00 BS03 1.00
6615010363198 BS01 1.00 BS02 1.00 BS03 1.00
6615012164822 BS01 1.00 BS02 1.00 BS03 1.00
6615012719168 BS01 1.00 BS02 1.00 BS03 1.00
6615012754675 BS01 1.00 BS02 1.00 BS03 1.00
6615012768318 BS01 1.00 BS02 1.00 BS03 1.00
6615012828765 BS01 1.00 BS02 1.00 BS03 1.00
6620012652887 BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK 1.00 1.00 1.00
1660012126399 1.00 1.00 1.00
4140011480459 1.00 1.00 1.00
5841011507527EK 1.00 1.00 1.00
5841011507528EK 1.00 1.00 1.00
5985011524173EK 1.00 1.00 1.00
6605012529480 1.00 1.00 1.00
6605012546944 1.00 1.00 1.00
6610011477221 1.00 1.00 1.00

```
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   3
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ  13
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   3
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   4
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   2
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   3
END
•
```

```
TREATMENT 4   2LM/FEDERAL EXPRESS/NO IRF/NO BUFFER STOCK
11  1.0      1.5  Version 6.4                              10      1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
   008 10
   011
   015  1
   020  1
   025  2 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ   1.0   1.0
BS02 DFHZ   1.0   1.0
BS03 DFHZ   1.0   1.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009       1.0
1280011826304EK X             29.0      0.0 60.0 30.0
1660012126399    DFHZ 3 0  1  1000.000030.00003       1.0
1660012126399   X           29.0      0.0 60.0 30.0
4140011480459    DFHZ 3 0  2  2000.000070.00007       1.0
4140011480459   X           29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037       1.0
5841011507527EK X             45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015       1.0
5841011507528EK X             45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004      1.0
5985011524173EK X             30.0      0.0 60.0 30.0
6605012529480    DFHZ 3 0  1  1000.000330.00033       1.0
6605012529480   X           30.0      0.0 60.0 30.0
6605012546944    DFHZ 3 0  1  1000.000230.00023       1.0
6605012546944   X           8.0      0.0 60.0 30.0
6610011477221    DFHZ 3 0  1  1000.000150.00015       1.0
```

```
6610011477221   X           8.0     0.0 60.0 30.0
6610012695437   DFHZ 3 0  2  2000.000130.00013      1.0
6610012695437   X          29.0     0.0 60.0 30.0
6610013076363   DFHZ 3 0  2  2000.000200.00020      1.0
6610013076363   X          29.0     0.0 60.0 30.0
6610013566949   DFHZ 3 0  6  6000.000130.00013      1.0
6610013566949   X          29.0     0.0 60.0 30.0
6615010351092   DFHZ 3 0  1  1000.000440.00044      1.0
6615010351092   X           9.0     0.0 60.0 30.0
6615010363198   DFHZ 3 0  1  1000.000190.00019      1.0
6615010363198   X          10.0     0.0 60.0 30.0
6615012164822   DFHZ 3 0  1  1000.000470.00047      1.0
6615012164822   X          32.0     0.0 60.0 30.0
6615012719168   DFHZ 3 0  1  1000.000200.00020      1.0
6615012719168   X          11.0     0.0 60.0 30.0
6615012754675   DFHZ 3 0  2  2000.000080.00008      1.0
6615012754675   X          29.0     0.0 60.0 30.0
6615012768318   DFHZ 3 0  2  2000.000210.00021      1.0
6615012768318   X           7.0     0.0 60.0 30.0
6615012828765   DFHZ 3 0  1  1000.000150.00015      1.0
6615012828765   X           4.0     0.0 60.0 30.0
6620012652887   DFHZ 3 0  1  1000.000490.00049      1.0
6620012652887   X          29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399   BS01 1.00 BS02 1.00 BS03 1.00
4140011480459   BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480   BS01 1.00 BS02 1.00 BS03 1.00
6605012546944   BS01 1.00 BS02 1.00 BS03 1.00
6610011477221   BS01 1.00 BS02 1.00 BS03 1.00
6610012695437   BS01 1.00 BS02 1.00 BS03 1.00
6610013076363   BS01 1.00 BS02 1.00 BS03 1.00
6610013566949   BS01 1.00 BS02 1.00 BS03 1.00
6615010351092   BS01 1.00 BS02 1.00 BS03 1.00
6615010363198   BS01 1.00 BS02 1.00 BS03 1.00
6615012164822   BS01 1.00 BS02 1.00 BS03 1.00
6615012719168   BS01 1.00 BS02 1.00 BS03 1.00
6615012754675   BS01 1.00 BS02 1.00 BS03 1.00
6615012768318   BS01 1.00 BS02 1.00 BS03 1.00
6615012828765   BS01 1.00 BS02 1.00 BS03 1.00
6620012652887   BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399    1.00 1.00 1.00
4140011480459    1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
```

```
6610012695437     1.00 1.00 1.00
6610013076363     1.00 1.00 1.00
6610013566949     1.00 1.00 1.00
6615010351092     1.00 1.00 1.00
6615010363198     1.00 1.00 1.00
6615012164822     1.00 1.00 1.00
6615012719168     1.00 1.00 1.00
6615012754675     1.00 1.00 1.00
6615012768318     1.00 1.00 1.00
6615012828765     1.00 1.00 1.00
6620012652887     1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   3
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ  13
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   3
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   4
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   2
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   3
END
```

```
TREATMENT 5  2LM/DEDICATED TRUCKING/NO IRF/ BUFFER STOCK AT BS01
1  1.0      1.5  Version 6.4                          10      1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009       1.0
1280011826304EK X          29.0      0.0 60.0 30.0
1660012126399    DFHZ 3 0  1  1000.000030.00003       1.0
1660012126399   X          29.0      0.0 60.0 30.0
4140011480459    DFHZ 3 0  2  2000.000070.00007       1.0
4140011480459   X          29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037       1.0
5841011507527EK X          45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015       1.0
5841011507528EK X          45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004      1.0
5985011524173EK X          30.0      0.0 60.0 30.0
6605012529480    DFHZ 3 0  1  1000.000330.00033       1.0
6605012529480   X          30.0      0.0 60.0 30.0
6605012546944    DFHZ 3 0  1  1000.000230.00023       1.0
6605012546944   X           8.0      0.0 60.0 30.0
6610011477221    DFHZ 3 0  1  1000.000150.00015       1.0
```

```
6610011477221  X          8.0     0.0 60.0 30.0
6610012695437  DFHZ 3 0  2  2000.000130.00013      1.0
6610012695437  X         29.0     0.0 60.0 30.0
6610013076363  DFHZ 3 0  2  2000.000200.00020      1.0
6610013076363  X         29.0     0.0 60.0 30.0
6610013566949  DFHZ 3 0  6  6000.000130.00013      1.0
6610013566949  X         29.0     0.0 60.0 30.0
6615010351092  DFHZ 3 0  1  1000.000440.00044      1.0
6615010351092  X          9.0     0.0 60.0 30.0
6615010363198  DFHZ 3 0  1  1000.000190.00019      1.0
6615010363198  X         10.0     0.0 60.0 30.0
6615012164822  DFHZ 3 0  1  1000.000470.00047      1.0
6615012164822  X         32.0     0.0 60.0 30.0
6615012719168  DFHZ 3 0  1  1000.000200.00020      1.0
6615012719168  X         11.0     0.0 60.0 30.0
6615012754675  DFHZ 3 0  2  2000.000080.00008      1.0
6615012754675  X         29.0     0.0 60.0 30.0
6615012768318  DFHZ 3 0  2  2000.000210.00021      1.0
6615012768318  X          7.0     0.0 60.0 30.0
6615012828765  DFHZ 3 0  1  1000.000150.00015      1.0
6615012828765  X          4.0     0.0 60.0 30.0
6620012652887  DFHZ 3 0  1  1000.000490.00049      1.0
6620012652887  X         29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480     1.00 1.00 1.00
6605012546944     1.00 1.00 1.00
6610011477221     1.00 1.00 1.00
```

```
6610012695437     1.00 1.00 1.00
6610013076363     1.00 1.00 1.00
6610013566949     1.00 1.00 1.00
6615010351092     1.00 1.00 1.00
6615010363198     1.00 1.00 1.00
6615012164822     1.00 1.00 1.00
6615012719168     1.00 1.00 1.00
6615012754675     1.00 1.00 1.00
6615012768318     1.00 1.00 1.00
6615012828765     1.00 1.00 1.00
6620012652887     1.00 1.00 1.00
STK
1280011826304EK  BS01   5 BS02   6 BS03   5 DFHZ  0
1660012126399    BS01   5 BS02   6 BS03   2 DFHZ  0
4140011480459    BS01   7 BS02  11 BS03   3 DFHZ  0
5841011507527EK  BS01  13 BS02  13 BS03   6 DFHZ  2
5841011507528EK  BS01  18 BS02  13 BS03   6 DFHZ  8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ  0
6605012529480    BS01   3 BS02   4 BS03   1 DFHZ  2
6605012546944    BS01   7 BS02   8 BS03   3 DFHZ  3
6610011477221    BS01   2 BS02   1 BS03   1 DFHZ  1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ  0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ  0
6610013566949    BS01   2 BS02   0 BS03   2 DFHZ  0
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ  0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ  0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ  0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ  0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ  0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ  0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ  0
6620012652887    BS01   2 BS02   5 BS03   3 DFHZ  2
END
```

```
TREATMENT 6  2LM/DEDICATED TRUCKING/NO IRF/ BUFFER STOCK AT BS02
11  1.0      1.5  Version 6.4                              10     1 1
475115838531914735277523314775315527952714736793689114718527224388917427322977 23
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009      1.0
1280011826304EK X            29.0      0.0 60.0 30.0
1660012126399    DFHZ 3 0  1  1000.000030.00003      1.0
1660012126399    X           29.0      0.0 60.0 30.0
4140011480459    DFHZ 3 0  2  2000.000070.00007      1.0
4140011480459    X           29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037      1.0
5841011507527EK X            45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015      1.0
5841011507528EK X            45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004     1.0
5985011524173EK X            30.0      0.0 60.0 30.0
6605012529480    DFHZ 3 0  1  1000.000330.00033      1.0
6605012529480    X           30.0      0.0 60.0 30.0
6605012546944    DFHZ 3 0  1  1000.000230.00023      1.0
6605012546944    X            8.0      0.0 60.0 30.0
6610011477221    DFHZ 3 0  1  1000.000150.00015      1.0
```

```
6610011477221  X          8.0    0.0 60.0 30.0
6610012695437  DFHZ 3 0  2  2000.000130.00013     1.0
6610012695437  X          29.0    0.0 60.0 30.0
6610013076363  DFHZ 3 0  2  2000.000200.00020     1.0
6610013076363  X          29.0    0.0 60.0 30.0
6610013566949  DFHZ 3 0  6  6000.000130.00013     1.0
6610013566949  X          29.0    0.0 60.0 30.0
6615010351092  DFHZ 3 0  1  1000.000440.00044     1.0
6615010351092  X          9.0    0.0 60.0 30.0
6615010363198  DFHZ 3 0  1  1000.000190.00019     1.0
6615010363198  X          10.0    0.0 60.0 30.0
6615012164822  DFHZ 3 0  1  1000.000470.00047     1.0
6615012164822  X          32.0    0.0 60.0 30.0
6615012719168  DFHZ 3 0  1  1000.000200.00020     1.0
6615012719168  X          11.0    0.0 60.0 30.0
6615012754675  DFHZ 3 0  2  2000.000080.00008     1.0
6615012754675  X          29.0    0.0 60.0 30.0
6615012768318  DFHZ 3 0  2  2000.000210.00021     1.0
6615012768318  X          7.0    0.0 60.0 30.0
6615012828765  DFHZ 3 0  1  1000.000150.00015     1.0
6615012828765  X          4.0    0.0 60.0 30.0
6620012652887  DFHZ 3 0  1  1000.000490.00049     1.0
6620012652887  X          29.0    0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399  BS01 1.00 BS02 1.00 BS03 1.00
4140011480459  BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480  BS01 1.00 BS02 1.00 BS03 1.00
6605012546944  BS01 1.00 BS02 1.00 BS03 1.00
6610011477221  BS01 1.00 BS02 1.00 BS03 1.00
6610012695437  BS01 1.00 BS02 1.00 BS03 1.00
6610013076363  BS01 1.00 BS02 1.00 BS03 1.00
6610013566949  BS01 1.00 BS02 1.00 BS03 1.00
6615010351092  BS01 1.00 BS02 1.00 BS03 1.00
6615010363198  BS01 1.00 BS02 1.00 BS03 1.00
6615012164822  BS01 1.00 BS02 1.00 BS03 1.00
6615012719168  BS01 1.00 BS02 1.00 BS03 1.00
6615012754675  BS01 1.00 BS02 1.00 BS03 1.00
6615012768318  BS01 1.00 BS02 1.00 BS03 1.00
6615012828765  BS01 1.00 BS02 1.00 BS03 1.00
6620012652887  BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1650012126399   1.00 1.00 1.00
4140011480459   1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480   1.00 1.00 1.00
6605012546944   1.00 1.00 1.00
6610011477221   1.00 1.00 1.00
```

```
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   7 BS03   5 DFHZ   0
1660012126399    BS01   4 BS02   7 BS03   2 DFHZ   0
4140011480459    BS01   6 BS02  12 BS03   3 DFHZ   0
5841011507527EK  BS01  12 BS02  14 BS03   6 DFHZ   2
5841011507528EK  BS01  13 BS02  18 BS03   6 DFHZ   8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   5 BS03   1 DFHZ   2
6605012546944    BS01   6 BS02   9 BS03   3 DFHZ   3
6610011477221    BS01   1 BS02   2 BS03   1 DFHZ   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   1 BS03   2 DFHZ   0
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   6 BS03   3 DFHZ   2
END
*
```

```
TREATMENT 7  2LM/DEDICATED TRUCKING/NO IRF/BUFFER STOCK AT BS03
11 1.0     1.5 Version 6.4                    10    1 1
4751158385319147352775233147753155279527147367936891147185272243889174273229772
 21 30 60 90
OPT
  008 10
  011
  015 1
  020 1
  025 3 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  3.0  3.0
BS02 DFHZ  3.0  3.0
BS03 DFHZ  2.0  2.0
ACFT
BS01 30
BS02 32
BS03 10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009     1.0
1280011826304EK X          29.0     0.0 60.0 30.0
1660012126399   DFHZ 3 0  1  1000.000030.00003     1.0
1660012126399   X          29.0     0.0 60.0 30.0
4140011480459   DFHZ 3 0  2  2000.000070.00007     1.0
4140011480459   X          29.0     0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037     1.0
5841011507527EK X          45.0     0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015     1.0
5841011507528EK X          45.0     0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004    1.0
5985011524173EK X          30.0     0.0 60.0 30.0
6605012529480   DFHZ 3 0  1  1000.000330.00033     1.0
6605012529480   X          30.0     0.0 60.0 30.0
6605012546944   DFHZ 3 0  1  1000.000230.00023     1.0
6605012546944   X           8.0     0.0 60.0 30.0
6610011477221   DFHZ 3 0  1  1000.000150.00015     1.0
```

```
6610011477221  X          8.0    0.0 60.0 30.0
6610012695437  DFHZ 3 0  2  2000.000130.00013   1.0
6610012695437  X          29.0    0.0 60.0 30.0
6610013076363  DFHZ 3 0  2  2000.000200.00020   1.0
6610013076363  X          29.0    0.0 60.0 30.0
6610013566949  DFHZ 3 0  6  6000.000130.00013   1.0
6610013566949  X          29.0    0.0 60.0 30.0
6615010351092  DFHZ 3 0  1  1000.000440.00044   1.0
6615010351092  X          9.0    0.0 60.0 30.0
6615010363198  DFHZ 3 0  1  1000.000190.00019   1.0
6615010363198  X          10.0    0.0 60.0 30.0
6615012164822  DFHZ 3 0  1  1000.000470.00047   1.0
6615012164822  X          32.0    0.0 60.0 30.0
6615012719168  DFHZ 3 0  1  1000.000200.00020   1.0
6615012719168  X          11.0    0.0 60.0 30.0
6615012754675  DFHZ 3 0  2  2000.000080.00008   1.0
6615012754675  X          29.0    0.0 60.0 30.0
6615012768318  DFHZ 3 0  2  2000.000210.00021   1.0
6615012768318  X          7.0    0.0 60.0 30.0
6615012828765  DFHZ 3 0  1  1000.000150.00015   1.0
6615012828765  X          4.0    0.0 60.0 30.0
6620012652887  DFHZ 3 0  1  1000.000490.00049   1.0
6620012652887  X          29.0    0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399   BS01 1.00 BS02 1.00 BS03 1.00
4140011480459   BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480   BS01 1.00 BS02 1.00 BS03 1.00
6605012546944   BS01 1.00 BS02 1.00 BS03 1.00
6610011477221   BS01 1.00 BS02 1.00 BS03 1.00
6610012695437   BS01 1.00 BS02 1.00 BS03 1.00
6610013076363   BS01 1.00 BS02 1.00 BS03 1.00
6610013566949   BS01 1.00 BS02 1.00 BS03 1.00
6615010351092   BS01 1.00 BS02 1.00 BS03 1.00
6615010363198   BS01 1.00 BS02 1.00 BS03 1.00
6615012164822   BS01 1.00 BS02 1.00 BS03 1.00
6615012719168   BS01 1.00 BS02 1.00 BS03 1.00
6615012754675   BS01 1.00 BS02 1.00 BS03 1.00
6615012768318   BS01 1.00 BS02 1.00 BS03 1.00
6615012828765   BS01 1.00 BS02 1.00 BS03 1.00
6620012652887   BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399    1.00 1.00 1.00
4140011480459    1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
```

```
6610012695437     1.00 1.00 1.00
6610013076363     1.00 1.00 1.00
6610013566949     1.00 1.00 1.00
6615010351092     1.00 1.00 1.00
6615010363198     1.00 1.00 1.00
6615012164822     1.00 1.00 1.00
6615012719168     1.00 1.00 1.00
6615012754675     1.00 1.00 1.00
6615012768318     1.00 1.00 1.00
6615012828765     1.00 1.00 1.00
6620012652887     1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   6 DFHZ   0
1660012126399    BS01   4 BS02   6 BS03   3 DFHZ   0
4140011486459    BS01   6 BS02  11 BS03   4 DFHZ   0
5841011507527EK  BS01  12 BS02  13 BS03   7 DFHZ   2
5841011507528EK  BS01  13 BS02  13 BS03  11 DFHZ   8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   2 BS02   4 BS03   2 DFHZ   2
6605012546944    BS01   6 BS02   8 BS03   4 DFHZ   3
6610011477271    BS01   1 BS02   1 BS03   2 DFHZ   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   1 BS02   0 BS03   3 DFHZ   0
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   1 BS02   5 BS03   4 DFHZ   2
END
•
```

```
TREATMENT 8   2LM/FEDERAL EXPRESS/NO IRF/BUFFER STOCK AT BS01
11  1.0      1.5  Version 6.4                          10     1 1
4751158385319147352775233147753155279527147367936891147185272243889174273229??23
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  2 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  1.0  1.0
BS02 DFHZ  1.0  1.0
BS03 DFHZ  1.0  1.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009      1.0
1280011826304EK X            29.0      0.0 60.0 30.0
1660012126399    DFHZ 3 0  1  1000.000030.00003      1.0
1660012126399   X            29.0      0.0 60.0 30.0
4140011480459    DFHZ 3 0  2  2000.000070.00007      1.0
4140011480459   X            29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037      1.0
5841011507527EK X            45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015      1.0
5841011507528EK X            45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004     1.0
5985011524173EK X            30.0      0.0 60.0 30.0
6605012529480    DFHZ 3 0  1  1000.000330.00033      1.0
6605012529480   X            30.0      0.0 60.0 30.0
6605012546944    DFHZ 3 0  1  1000.000230.00023      1.0
6605012546944   X             8.0      0.0 60.0 30.0
6610011477221    DFHZ 3 0  1  1000.000150.00015      1.0
```

```
6610011477221  X           8.0    0.0 60.0 30.0
6610012695437  DFHZ 3 0  2  2000.000130.00013     1.0
6610012695437  X          29.0    0.0 60.0 30.0
6610013076363  DFHZ 3 0  2  2000.000200.00020     1.0
6610013076363  X          29.0    0.0 60.0 30.0
6610013566949  DFHZ 3 0  6  6000.000130.00013     1.0
6610013566949  X          29.0    0.0 60.0 30.0
6615010351092  DFHZ 3 0  1  1000.000440.00044     1.0
6615010351092  X           9.0    0.0 60.0 30.0
6615010363198  DFHZ 3 0  1  1000.000190.00019     1.0
6615010363198  X          10.0    0.0 60.0 30.0
6615012164822  DFHZ 3 0  1  1000.000470.00047     1.0
6615012164822  X          32.0    0.0 60.0 30.0
6615012719168  DFHZ 3 0  1  1000.000200.00020     1.0
6615012719168  X          11.0    0.0 60.0 30.0
6615012754675  DFHZ 3 0  2  2000.000080.00008     1.0
6615012754675  X          29.0    0.0 60.0 30.0
6615012768318  DFHZ 3 0  2  2000.000210.00021     1.0
6615012768318  X           7.0    0.0 60.0 30.0
6615012828765  DFHZ 3 0  1  1000.000150.00015     1.0
6615012828765  X           4.0    0.0 60.0 30.0
6620012652887  DFHZ 3 0  1  1000.000490.00049     1.0
6620012652887  X          29.0    0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
6605012529480     1.00 1.00 1.00
6605012546944     1.00 1.00 1.00
6610011477221     1.00 1.00 1.00
```

```
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   5 BS02   6 BS03   5 DFHZ   0
1660012126399    BS01   5 BS02   6 BS03   2 DFHZ   0
4140011480459    BS01   7 BS02  11 BS03   3 DFHZ   0
5841011507527EK  BS01  13 BS02  13 BS03   6 DFHZ   2
5841011507528EK  BS01  18 BS02  13 BS03   6 DFHZ   8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480    BS01   3 BS02   4 BS03   1 DFHZ   2
6605012546944    BS01   7 BS02   8 BS03   3 DFHZ   3
6610011477221    BS01   2 BS02   1 BS03   1 DFHZ   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949    BS01   2 BS02   0 BS03   2 DFHZ   0
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887    BS01   2 BS02   5 BS03   3 DFHZ   2
END
```

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TREATMENT 9  2LM/FEDERAL EXPRESS/NO IRF/BUFFER STOCK AT BS02
11 1.0     1.5 Version 6.4                    10     1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21 30 60 90
OPT
  008 10
  011
  015 1
  020 1
  025 2 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  1.0  1.0
BS02 DFHZ  1.0  1.0
BS03 DFHZ  1.0  1.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
12800118263O4EK  DFHZ 3 0  1  1000.000090.00009      1.0
12800118263O4EK X           29.0      0.0 60.0 30.0
1660012126399   DFHZ 3 0  1  1000.000030.00003     1.0
1660012126399   X           29.0      0.0 60.0 30.0
4140011480459   DFHZ 3 0  2  2000.000070.00007     1.0
4140011480459   X           29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 3 0  2  2000.000370.00037     1.0
5841011507527EK X           45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 3 0  2  2000.000150.00015     1.0
5841011507528EK X           45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 3 0  1  100 0.000040.00004     1.0
5985011524173EK X           30.0      0.0 60.0 30.0
6605012529480   DFHZ 3 0  1  1000.000330.00033     1.0
6605012529480   X           30.0      0.0 60.0 30.0
6605012546944   DFHZ 3 0  1  1000.000230.00023     1.0
6605012546944   X           8.0      0.0 60.0 30.0
6610011477221   DFHZ 3 0  1  1000.000150.00015     1.0
```

6610011477221 X 8.0 0.0 60.0 30.0
6610012695437 DFHZ 3 0 2 2000.000130.00013 1.0
6610012695437 X 29.0 0.0 60.0 30.0
6610013076363 DFHZ 3 0 2 2000.000200.00020 1.0
6610013076363 X 29.0 0.0 60.0 30.0
6610013566949 DFHZ 3 0 6 6000.000130.00013 1.0
6610013566949 X 29.0 0.0 60.0 30.0
6615010351092 DFHZ 3 0 1 1000.000440.00044 1.0
6615010351092 X 9.0 0.0 60.0 30.0
6615010363198 DFHZ 3 0 1 1000.000190.00019 1.0
6615010363198 X 10.0 0.0 60.0 30.0
6615012164822 DFHZ 3 0 1 1000.000470.00047 1.0
6615012164822 X 32.0 0.0 60.0 30.0
6615012719168 DFHZ 3 0 1 1000.000200.00020 1.0
6615012719168 X 11.0 0.0 60.0 30.0
6615012754675 DFHZ 3 0 2 2000.000080.00008 1.0
6615012754675 X 29.0 0.0 60.0 30.0
6615012768318 DFHZ 3 0 2 2000.000210.00021 1.0
6615012768318 X 7.0 0.0 60.0 30.0
6615012828765 DFHZ 3 0 1 1000.000150.00015 1.0
6615012828765 X 4.0 0.0 60.0 30.0
6620012652887 DFHZ 3 0 1 1000.000490.00049 1.0
6620012652887 X 29.0 0.0 60.0 30.0
APPL
1280011826304EK BS01 1.00 BS02 1.00 BS03 1.00
1660012126399 BS01 1.00 BS02 1.00 BS03 1.00
4140011480459 BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK BS01 1.00 BS02 1.00 BS03 1.00
6605012529480 BS01 1.00 BS02 1.00 BS03 1.00
6605012546944 BS01 1.00 BS02 1.00 BS03 1.00
6610011477221 BS01 1.00 BS02 1.00 BS03 1.00
6610012695437 BS01 1.00 BS02 1.00 BS03 1.00
6610013076363 BS01 1.00 BS02 1.00 BS03 1.00
6610013566949 BS01 1.00 BS02 1.00 BS03 1.00
6615010351092 BS01 1.00 BS02 1.00 BS03 1.00
6615010363198 BS01 1.00 BS02 1.00 BS03 1.00
6615012164822 BS01 1.00 BS02 1.00 BS03 1.00
6615012719168 BS01 1.00 BS02 1.00 BS03 1.00
6615012754675 BS01 1.00 BS02 1.00 BS03 1.00
6615012768318 BS01 1.00 BS02 1.00 BS03 1.00
6615012828765 BS01 1.00 BS02 1.00 BS03 1.00
6620012652887 BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK 1.00 1.00 1.00
1660012126399 1.00 1.00 1.00
4140011480459 1.00 1.00 1.00
5841011507527EK 1.00 1.00 1.00
5841011507528EK 1.00 1.00 1.00
5985011524173EK 1.00 1.00 1.00
6605012529480 1.00 1.00 1.00
6605012546944 1.00 1.00 1.00
6610011477221 1.00 1.00 1.00

```
6610012695437     1.00 1.00 1.00
6610013076363     1.00 1.00 1.00
6610013566949     1.00 1.00 1.00
6615010351092     1.00 1.00 1.00
6615010363198     1.00 1.00 1.00
6615012164822     1.00 1.00 1.00
6615012719168     1.00 1.00 1.00
6615012754675     1.00 1.00 1.00
6615012768318     1.00 1.00 1.00
6615012828765     1.00 1.00 1.00
6620012652887     1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   7 BS03   5 DFHZ   0
1660012126399   BS01   4 BS02   7 BS03   2 DFHZ   0
4140011480459   BS01   6 BS02  12 BS03   3 DFHZ   0
5841011507527EK  BS01  12 BS02  14 BS03   6 DFHZ   2
5841011507528EK  BS01  13 BS02  18 BS03   6 DFHZ   8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0
6605012529480   BS01   2 BS02   5 BS03   1 DFHZ   2
6605012546944   BS01   6 BS02   9 BS03   3 DFHZ   3
6610011477221   BS01   1 BS02   2 BS03   1 DFHZ   1
6610012695437   BS01   3 BS02   1 BS03   2 DFHZ   0
6610013076363   BS01   5 BS02   2 BS03   1 DFHZ   0
6610013566949   BS01   1 BS02   1 BS03   2 DFHZ   0
6615010351092   BS01   1 BS02   1 BS03   0 DFHZ   0
6615010363198   BS01   4 BS02   6 BS03   1 DFHZ   0
6615012164822   BS01   4 BS02   7 BS03   1 DFHZ   0
6615012719168   BS01   1 BS02   0 BS03   0 DFHZ   0
6615012754675   BS01   4 BS02   1 BS03   0 DFHZ   0
6615012768318   BS01   1 BS02   1 BS03   0 DFHZ   0
6615012828765   BS01   2 BS02   0 BS03   0 DFHZ   0
6620012652887   BS01   1 BS02   6 BS03   3 DFHZ   2
END
•
```

```
TREATMENT 10  2LM/FEDERAL EXPRESS/NO IRF/BUFFER STOCK AT BS03
11 1.0    1.5 Version 6.4                          10     1 1
4751158385319147352775233147753155279527147367936891147185272243889174273229772з
 21 30 60 90
OPT
  008 10
  011
  015 1
  020 1
  025 2 0.01
DEPT
DFHZ
BASE
BS01
BS02
BS03
TRNS
BS01 DFHZ  1.0  1.0
BS02 DFHZ  1.0  1.0
BS03 DFHZ  1.0  1.0
ACFT
BS01 30
BS02 32
BS03 10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 3 0  1  1000.000090.00009      1.0
1280011826304EK X            29.0      0.0 60.0 30.0
1660012126399   DFHZ 3 0  1  1000.000030.00003      1.0
1660012126399   X            29.0      0.0 60.0 30.0
4140011480459   DFHZ 3 0  2  2000.000070.00007      1.0
4140011480459   X            29.0      0.0 60.0 30.0
5841011507527EK DFHZ 3 0  2  2000.000370.00037      1.0
5841011507527EK X            45.0      0.0 60.0 30.0
5841011507528EK DFHZ 3 0  2  2000.000150.00015      1.0
5841011507528EK X            45.0      0.0 60.0 30.0
5985011524173EK DFHZ 3 0  1  100 0.000040.00004     1.0
5985011524173EK X            30.0      0.0 60.0 30.0
6605012529480   DFHZ 3 0  1  1000.000330.00033      1.0
6605012529480   X            30.0      0.0 60.0 30.0
6605012546944   DFHZ 3 0  1  1000.000230.00023      1.0
6605012546944   X             8.0      0.0 60.0 30.0
6610011477221   DFHZ 3 0  1  1000.000150.00015      1.0
```

```
6610011477221  X          8.0     0.0 60.0 30.0
6610012695437  DFHZ 3 0  2  2000.000130.00013     1.0
6610012695437  X          29.0    0.0 60.0 30.0
6610013076363  DFHZ 3 0  2  2000.000200.00020     1.0
6610013076363  X          29.0    0.0 60.0 30.0
6610013566949  DFHZ 3 0  6  6000.000130.00013     1.0
6610013566949  X          29.0    0.0 60.0 30.0
6615010351092  DFHZ 3 0  1  1000.000440.00044     1.0
6615010351092  X          9.0     0.0 60.0 30.0
6615010363198  DFHZ 3 0  1  1000.000190.00019     1.0
6615010363198  X          10.0    0.0 60.0 30.0
6615012164822  DFHZ 3 0  1  1000.000470.00047     1.0
6615012164822  X          32.0    0.0 60.0 30.0
6615012719168  DFHZ 3 0  1  1000.000200.00020     1.0
6615012719168  X          11.0    0.0 60.0 30.0
6615012754675  DFHZ 3 0  2  2000.000080.00008     1.0
6615012754675  X          29.0    0.0 60.0 30.0
6615012768318  DFHZ 3 0  2  2000.000210.00021     1.0
6615012768318  X          7.0     0.0 60.0 30.0
6615012828765  DFHZ 3 0  1  1000.000150.00015     1.0
6615012828765  X          4.0     0.0 60.0 30.0
6620012652887  DFHZ 3 0  1  1000.000490.00049     1.0
6620012652887  X          29.0    0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK  1.00 1.00 1.00
1660012126399    1.00 1.00 1.00
4140011480459    1.00 1.00 1.00
5841011507527EK  1.00 1.00 1.00
5841011507528EK  1.00 1.00 1.00
5985011524173EK  1.00 1.00 1.00
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
```

```
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   6 DFHZ  0
1660012126399    BS01   4 BS02   6 BS03   3 DFHZ  0
4140011480459    BS01   6 BS02  11 BS03   4 DFHZ  0
5841011507527EK  BS01  12 BS02  13 BS03   7 DFHZ  2
5841011507528EK  BS01  13 BS02  13 BS03  11 DFHZ  8
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ  0
6605012529480    BS01   2 BS02   4 BS03   2 DFHZ  2
6605012546944    BS01   6 BS02   8 BS03   4 DFHZ  3
6610011477221    BS01   1 BS02   1 BS03   2 DFHZ  1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ  0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ  0
6610013566949    BS01   1 BS02   0 BS03   3 DFHZ  0
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ  0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ  0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ  0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ  0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ  0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ  0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ  0
6620012652887    BS01   1 BS02   5 BS03   4 DFHZ  2
END
•
```

```
TREATMENT 11   2LM/ DEDICATED TRUCKING/ IRF AT BS01/ NO BUFFER STOCK
1  1.0  1.0  1.5  Version 6.4                         10     1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
CIRF
IRF1
BASE
BS01IRF1  0.1  0.1
BS02IRF1  4.0  4.0
BS03IRF1  3.0  3.0
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
IRF1 DFHZ   3.0   3.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
128001182630 4EK  DFHZ 2 1  1  1000.000090.00009            1.0
1280011826304EK X 6.0  .16     29.0     0.0 60.0 30.0
1660012126399    DFHZ 2 1  1  1000.000030.00003            1.0
1660012126399   X 5.0  .95     29.0     0.0 60.0 30.0
4140011480459    DFHZ 2 1  2  2000.000070.00007            1.0
4140011480459   X 6.0  .96     29.0     0.0 60.0 30.0
5841011507527EK  DFHZ 2 1  2  2000.000370.00037            1.0
5841011507527EK X26.0  .53     45.0     0.0 60.0 30.0
5841011507528EK  DFHZ 2 1  2  2000.000150.00015            1.0
5841011507528EK X31.0  .63     45.0     0.0 60.0 30.0
5985011524173EK  DFHZ 2 1  1  1000.000040.00004            1.0
5985011524173EK X 6.0  .52     30.0     0.0 60.0 30.0
6605012529480    DFHZ 2 1  1  1000.000330.00033            1.0
6605012529480   X 5.0  .47     30.0     0.0 60.0 30.0
```

```
6605012546944   DFHZ 2 1  1  1000.000230.00023                    1.0
6605012546944   X14.0  .46      8.0     0.0 60.0 30.0
6610011477221   DFHZ 2 1  1  1000.000150.00015                    1.0
6610011477221   X 4.0  .18      8.0     0.0 60.0 30.0
6610012695437   DFHZ 2 1  2  2000.000130.00013                    1.0
6610012695437   X 6.0  .47     29.0     0.0 60.0 30.0
6610013076363   DFHZ 2 1  2  2000.000200.00020                    1.0
6610013076363   X 5.0  .39     29.0     0.0 60.0 30 0
6610013566949   DFHZ 2 1  6  6000.000130.00013                    1.0
6610013566949   X 5.0  1.0     29.0     0.0 60.0 30.0
6615010351092   DFHZ 2 1  1  1000.000440.00044                    1.0
6615010351092   X 9.0  .18      9.0     0.0 60.0 30.0
6615010363198   DFHZ 2 1  1  1000.000190.00019                    1.0
6615010363198   X 5.0  .32     10.0     0.0 60.0 30.0
6615012164822   DFHZ 2 1  1  1000.000470.00047                    1.0
6615012164822   X 1.0  1.0     32.0     0.0 60.0 30.0
6615012719168   DFHZ 2 1  1  1000.000200.00020                    1.0
6615012719168   X 3.0  .45     11.0     0.0 60.0 30.0
6615012754675   DFHZ 2 1  2  2000.000080.00008                    1.0
6615012754675   X 4.0  .31     29.0     0.0 60.0 30.0
6615012768318   DFHZ 2 1  2  2000.000210.00021                    1.0
6615012768318   X 5.0  .49      7.0     0.0 60.0 30.0
6615012828765   DFHZ 2 1  1  1000.000150.00015                    1.0
6615012828765   X 7.0  .39      4.0     0.0 60.0 30.0
6620012652887   DFHZ 2 1  1  1000.000490.00049                    1.0
6620012652887   X 5.0  .27     29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
```

```
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   0 IRF1   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   0 IRF1   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   0 IRF1   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   2 IRF1   1
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ   8 IRF1   5
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   2 IRF1   1
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   3 IRF1   1
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   1 IRF1   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0 IRF1   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0 IRF1   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   0 IRF1   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0 IRF1   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0 IRF1   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0 IRF1   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   2 IRF1   1
END
```

```
TREATMENT 12  2LM/ DEDICATED TRUCKING/ IRF AT BS02/ NO BUFFER STOCK
1  1.0 1.0 1.5 Version 6.4                    10    1 1
4751158385319147352775233147753155279527147367936891147185272224388917427322297723
 21 30 60 90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
CIRF
IRF1
BASE
BS01IRF1  3.0  3.0
BS02IRF1  0.1  0.1
BS03IRF1  3.0  3.0
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
IRF1 DFHZ   3.0   3.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 2 1  1  1000.000090.00009           1.0
1280011826304EK X 6.0  .16     29.0     0.0 60.0 30.0
1660012126399   DFHZ 2 1  1  1000.000030.00003            1.0
1660012126399   X 5.0  .95     29.0     0.0 60.0 30.0
4140011480459   DFHZ 2 1  2  2000.000070.00007            1.0
4140011480459   X 6.0  .96     29.0     0.0 60.0 30.0
5841011507527EK  DFHZ 2 1  2  2000.000370.00037           1.0
5841011507527EK X26.0  .53     45.0     0.0 60.0 30.0
5841011507528EK  DFHZ 2 1  2  2000.000150.00015           1.0
5841011507528EK X31.0  .63     45.0     0.0 60.0 30.0
5985011524173EK  DFHZ 2 1  1  1000.000040.00004           1.0
5985011524173EK X 6.0  .52     30.0     0.0 60.0 30.0
6605012529480   DFHZ 2 1  1  1000.000330.00033            1.0
6605012529480   X 5.0  .47     30.0     0.0 60.0 30.0
```

```
6605012546944   DFHZ 2 1  1  1000.000230.00023                1.0
6605012546944   X14.0 .46     8.0     0.0 60.0 30.0
6610011477221   DFHZ 2 1  1  1000.000150.00015                1.0
6610011477221   X 4.0 .18     8.0     0.0 60.0 30.0
6610012695437   DFHZ 2 1  2  2000.000130.00013                1.0
6610012695437   X 6.0 .47    29.0     0.0 60.0 30.0
6610013076363   DFHZ 2 1  2  2000.000200.00020                1.0
6610013076363   X 5.0 .39    29.0     0.0 60.0 30.0
6610013566949   DFHZ 2 1  6  6000.000130.00013                1.0
6610013566949   X 5.0 1.0    29.0     0.0 60.0 30.0
6615010351092   DFHZ 2 1  1  1000.000440.00044                1.0
6615010351092   X 9.0 .18     9.0     0.0 60.0 30.0
6615010363198   DFHZ 2 1  1  1000.000190.00019                1.0
6615010363198   X 5.0 .32    10.0     0.0 60.0 30.0
6615012164822   DFHZ 2 1  1  1000.000470.00047                1.0
6615012164822   X 1.0 1.0    32.0     0.0 60.0 30.0
6615012719168   DFHZ 2 1  1  1000.000200.00020                1.0
6615012719168   X 3.0 .45    11.0     0.0 60.0 30.0
6615012754675   DFHZ 2 1  2  2000.000080.00008                1.0
6615012754675   X 4.0 .31    29.0     0.0 60.0 30.0
6615012768318   DFHZ 2 1  2  2000.000210.00021                1.0
6615012768318   X 5.0 .49     7.0     0.0 60.0 30.0
6615012828765   DFHZ 2 1  1  1000.000150.00015                1.0
6615012828765   X 7.0 .39     4.0     0.0 60.0 30.0
6620012652887   DFHZ 2 1  1  1000.000490.00049                1.0
6620012652887   X 5.0 .27    29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK    1.00 1.00 1.00
1660012126399    1.00 1.00 1.00
4140011480459    1.00 1.00 1.00
5841011507527EK    1.00 1.00 1.00
5841011507528EK    1.00 1.00 1.00
5985011524173EK    1.00 1.00 1.00
```

```
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   0 IRF1   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   0 IRF1   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   0 IRF1   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   2 IRF1   1
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ   8 IRF1   5
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   2 IRF1   1
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   3 IRF1   1
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   1 IRF1   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0 IRF1   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0 IRF1   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   0 IRF1   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0 IRF1   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0 IRF1   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0 IRF1   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   2 IRF1   1
END
.
```

```
TREATMENT 13  2LM/ DEDICATED TRUCKING/ IRF AT BS03/ NO BUFFER STOCK
1  1.0  1.0  1.5  Version 6.4                          10    1 1
4751158385319147352775233147753155279527147367936891147185272243889174273229 7723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
CIRF
IRF1
BASE
BS01IRF1  3.0  3.0
BS02IRF1  3.0  3.0
BS03IRF1  0.1  0.1
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
IRF1 DFHZ   2.0   2.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 2 1  1  1000.000090.00009              1.0
1280011826304EK X 6.0  .16     29.0      0.0 60.0 30.0
1660012126399   DFHZ 2 1  1  1000.000030.00003              1.0
1660012126399   X 5.0  .95     29.0      0.0 60.0 30.0
4140011480459   DFHZ 2 1  2  2000.000070.00007              1.0
4140011480459   X 6.0  .96     29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 2 1  2  2000.000370.00037              1.0
5841011507527EK X26.0  .53     45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 2 1  2  2000.000150.00015              1.0
5841011507528EK X31.0  .63     45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 2 1  1  1000.000040.00004              1.0
5985011524173EK X 6.0  .52     30.0      0.0 60.0 30.0
6605012529480   DFHZ 2 1  1  1000.000330.00033              1.0
6605012529480   X 5.0  .47     30.0      0.0 60.0 30.0
```

```
6605012546944  DFHZ 2 1  1  1000.000230.00023            1.0
6605012546944  X14.0 .46     8.0     0.0 60.0 30.0
6610011477221  DFHZ 2 1  1  1000.000150.00015            1.0
6610011477221  X 4.0  .18    3.0     0.0 60.0 30.0
6610012695437  DFHZ 2 1  2  2000.000130.00013            1.0
6610012695437  X 6.0  .47   29.0     0.0 60.0 30.0
6610013076363  DFHZ 2 1  2  2000.000200.00020            1.0
6610013076363  X 5.0  .39   29.0     0.0 60.0 30.0
6610013566949  DFHZ 2 1  6  6000.000130.00013            1.0
6610013566949  X 5.0  1.0   29.0     0.0 60.0 30.0
6615010351092  DFHZ 2 1  1  1000.000440.00044            1.0
6615010351092  X 9.0  .18    9.0     0.0 60.0 30.0
6615010363198  DFHZ 2 1  1  1000.000190.00019            1.0
6615010363198  X 5.0  .32   10.0     0.0 60.0 30.0
6615012164822  DFHZ 2 1  1  1000.000470.00047            1.0
6615012164822  X 1.0  1.0   32.0     0.0 60.0 30.0
6615012719168  DFHZ 2 1  1  1000.000200.00020            1.0
6615012719168  X 3.0  .45   11.0     0.0 60.0 30.0
6615012754675  DFHZ 2 1  2  2000.000080.00008            1.0
6615012754675  X 4.0  .31   29.0     0.0 60.0 30.0
6615012768318  DFHZ 2 1  2  2000.000210.00021            1.0
6615012768318  X 5.0  .49    7.0     0.0 60.0 30.0
6615012828765  DFHZ 2 1  1  1000.000150.00015            1.0
6615012828765  X 7.0  .39    4.0     0.0 60.0 30.0
6620012652887  DFHZ 2 1  1  1000.000490.00049            1.0
6620012652887  X 5.0  .27   29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
```

```
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   0 IRF1   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   0 IRF1   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   0 IRF1   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   2 IRF1   1
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ   8 IRF1   5
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   2 IRF1   1
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   3 IRF1   1
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   1 IRF1   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0 IRF1   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0 IRF1   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   0 IRF1   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0 IRF1   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0 IRF1   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0 IRF1   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   2 IRF1   1
END
```

```
TREATMENT 13  2LM/ DEDICATED TRUCKING/ IRF AT BS03/ NO BUFFER STOCK
1  1.0  1.0  1.5  Version 6.4                         10     1 1
4751158385319147352775233147753155279527147367936891147185272243889174273229772З
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  3 0.01
DEPT
DFHZ
CIRF
IRF1
BASE
BS01IRF1  3.0  3.0
BS02IRF1  3.0  3.0
BS03IRF1  0.1  0.1
TRNS
BS01 DFHZ   3.0   3.0
BS02 DFHZ   3.0   3.0
BS03 DFHZ   2.0   2.0
IRF1 DFHZ  2.0   2.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 2 1  1  1000.000090.00009             1.0
1280011826304EK X 6.0  .16      29.0      0.0 60.0 30.0
1660012126399    DFHZ 2 1  1  1000.000030.00003             1.0
1660012126399   X 5.0  .95      29.0      0.0 60.0 30.0
4140011480459    DFHZ 2 1  2  2000.000070.00007             1.0
4140011480459   X 6.0  .96      29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 2 1  2  2000.000370.00037             1.0
5841011507527EK X26.0  .53      45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 2 1  2  2000.000150.00015             1.0
5841011507528EK X31.0  .63      45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 2 1  1  1000.000040.00004             1.0
5985011524173EK X 6.0  .52      30.0      0.0 60.0 30.0
6605012529480    DFHZ 2 1  1  1000.000330.00033             1.0
6605012529480   X 5.0  .47      30.0      0.0 60.0 30.0
```

```
6605012546944   DFHZ 2 1  1  1000.000230.00023              1.0
6605012546944   X14.0  .46     8.0     0.0 60.0 30.0
6610011477221   DFHZ 2 1  1  1000.000150.00015              1.0
6610011477221   X 4.0  .18     8.0     0.0 60.0 30.0
6610012695437   DFHZ 2 1  2  2000.000130.00013              1.0
6610012695437   X 6.0  .47    29.0     0.0 60.0 30.0
6610013076363   DFHZ 2 1  2  2000.000200.00020              1.0
6610013076363   X 5.0  .39    29.0     0.0 60.0 30.0
6610013566949   DFHZ 2 1  6  6000.000130.00013              1.0
6610013566949   X 5.0  1.0    29.0     0.0 60.0 30.0
6615010351092   DFHZ 2 1  1  1000.000440.00044              1.0
6615010351092   X 9.0  .18     9.0     0.0 60.0 30.0
6615010363198   DFHZ 2 1  1  1000.000190.00019              1.0
6615010363198   X 5.0  .32    10.0     0.0 60.0 30.0
6615012164822   DFHZ 2 1  1  1000.000470.00047              1.0
6615012164822   X 1.0  1.0    32.0     0.0 60.0 30.0
6615012719168   DFHZ 2 1  1  1000.000200.00020              1.0
6615012719168   X 3.0  .45    11.0     0.0 60.0 30.0
6615012754675   DFHZ 2 1  2  2000.000080.00008              1.0
6615012754675   X 4.0  .31    29.0     0.0 60.0 30.0
6615012768318   DFHZ 2 1  2  2000.000210.00021              1.0
6615012768318   X 5.0  .49     7.0     0.0 60.0 30.0
6615012828765   DFHZ 2 1  1  1000.000150.00015              1.0
6615012828765   X 7.0  .39     4.0     0.0 60.0 30.0
6620012652887   DFHZ 2 1  1  1000.000490.00049              1.0
6620012652887   X 5.0  .27    29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
```

```
6605012529480    1.00 1.00 1.00
6605012546944    1.00 1.00 1.00
6610011477221    1.00 1.00 1.00
6610012695437    1.00 1.00 1.00
6610013076363    1.00 1.00 1.00
6610013566949    1.00 1.00 1.00
6615010351092    1.00 1.00 1.00
6615010363198    1.00 1.00 1.00
6615012164822    1.00 1.00 1.00
6615012719168    1.00 1.00 1.00
6615012754675    1.00 1.00 1.00
6615012768318    1.00 1.00 1.00
6615012828765    1.00 1.00 1.00
6620012652887    1.00 1.00 1.00
STK
1280011826304EK  BS01   4 BS02   6 BS03   5 DFHZ   0 IRF1   1
1660012126399    BS01   4 BS02   6 BS03   2 DFHZ   0 IRF1   1
4140011480459    BS01   6 BS02  11 BS03   3 DFHZ   0 IRF1   1
5841011507527EK  BS01  12 BS02  13 BS03   6 DFHZ   2 IRF1   1
5841011507528EK  BS01  13 BS02  13 BS03   6 DFHZ   8 IRF1   5
5985011524173EK  BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6605012529480    BS01   2 BS02   4 BS03   1 DFHZ   2 IRF1   1
6605012546944    BS01   6 BS02   8 BS03   3 DFHZ   3 IRF1   1
6610011477221    BS01   1 BS02   1 BS03   1 DFHZ   1 IRF1   1
6610012695437    BS01   3 BS02   1 BS03   2 DFHZ   0 IRF1   0
6610013076363    BS01   5 BS02   2 BS03   1 DFHZ   0 IRF1   0
6610013566949    BS01   1 BS02   0 BS03   2 DFHZ   0 IRF1   1
6615010351092    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615010363198    BS01   4 BS02   6 BS03   1 DFHZ   0 IRF1   0
6615012164822    BS01   4 BS02   7 BS03   1 DFHZ   0 IRF1   0
6615012719168    BS01   1 BS02   0 BS03   0 DFHZ   0 IRF1   0
6615012754675    BS01   4 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012768318    BS01   1 BS02   1 BS03   0 DFHZ   0 IRF1   0
6615012828765    BS01   2 BS02   0 BS03   0 DFHZ   0 IRF1   0
6620012652887    BS01   1 BS02   5 BS03   3 DFHZ   2 IRF1   1
END
```

```
TREATMENT 15  2LM/ FEDERAL EXPRESS/ IRF AT BS02/ NO BUFFER STOCK
1  1.0  1.0  1.5  Version 6.4                          10     1 1
47511583853191473527752331477531552795271473679368911471852722438891742732297723
 21  30  60  90
OPT
  008 10
  011
  015  1
  020  1
  025  2 0.01
DEPT
DFHZ
CIRF
IRF1
BASE
BS01IRF1  1.0  1.0
BS02IRF1  0.1  0.1
BS03IRF1  1.0  1.0
TRNS
BS01 DFHZ   1.0   1.0
BS02 DFHZ   1.0   1.0
BS03 DFHZ   1.0   1.0
IRF1 DFHZ   1.0   1.0
ACFT
BS01  30
BS02  32
BS03  10
SRTS
BS01 0.4
BS02 0.4
BS03 0.3
FLHR
BS01 4.5
BS02 4.5
BS03 4.5
TURN
BS01 1.0
BS02 1.0
BS03 1.0
LRU
1280011826304EK  DFHZ 2 1   1  1000.000090.00009                  1.0
1280011826304EK X 6.0  .16      29.0      0.0 60.0 30.0
1660012126399    DFHZ 2 1   1  1000.000030.00003                  1.0
1660012126399   X 5.0  .95      29.0      0.0 60.0 30.0
4140011480459    DFHZ 2 1   2  2000.000070.00007                  1.0
4140011480459   X 6.0  .96      29.0      0.0 60.0 30.0
5841011507527EK  DFHZ 2 1   2  2000.000370.00037                  1.0
5841011507527EK X26.0  .53      45.0      0.0 60.0 30.0
5841011507528EK  DFHZ 2 1   2  2000.000150.00015                  1.0
5841011507528EK X31.0  .63      45.0      0.0 60.0 30.0
5985011524173EK  DFHZ 2 1   1  1000.000040.00004                  1.0
5985011524173EK X 6.0  .52      30.0      0.0 60.0 30.0
6605012529480    DFHZ 2 1   1  1000.000330.00033                  1.0
6605012529480   X 5.0  .47      30.0      0.0 60.0 30.0
```

```
6605012546944   DFHZ 2 1  1  1000.000230.00023              1.0
6605012546944   X14.0 .46     8.0     0.0 60.0 30.0
6610011477221   DFHZ 2 1  1  1000.000150.00015              1.0
6610011477221   X 4.0 .18     8.0     0.0 60.0 30.0
6610012695437   DFHZ 2 1  2  2000.000130.00013              1.0
6610012695437   X 6.0 .47    29.0     0.0 60.0 30.0
6610013076363   DFHZ 2 1  2  2000.000200.00020              1.0
6610013076363   X 5.0 .39    29.0     0.0 60.0 30.0
6610013566949   DFHZ 2 1  6  6000.000130.00013              1.0
6610013566949   X 5.0 1.0    29.0     0.0 60.0 30.0
6615010351092   DFHZ 2 1  1  1000.000440.00044              1.0
6615010351092   X 9.0 .18     9.0     0.0 60.0 30.0
6615010363198   DFHZ 2 1  1  1000.000190.00019              1.0
6615010363198   X 5.0 .32    10.0     0.0 60.0 30.0
6615012164822   DFHZ 2 1  1  1000.000470.00047              1.0
6615012164822   X 1.0 1.0    32.0     0.0 60.0 30.0
6615012719168   DFHZ 2 1  1  1000.000200.00020              1.0
6615012719168   X 3.0 .45    11.0     0.0 60.0 30.0
6615012754675   DFHZ 2 1  2  2000.000080.00008              1.0
6615012754675   X 4.0 .31    29.0     0.0 60.0 30.0
6615012768318   DFHZ 2 1  2  2000.000210.00021              1.0
6615012768318   X 5.0 .49     7.0     0.0 60.0 30.0
6615012828765   DFHZ 2 1  1  1000.000150.00015              1.0
6615012828765   X 7.0 .39     4.0     0.0 60.0 30.0
6620012652887   DFHZ 2 1  1  1000.000490.00049              1.0
6620012652887   X 5.0 .27    29.0     0.0 60.0 30.0
APPL
1280011826304EK  BS01 1.00 BS02 1.00 BS03 1.00
1660012126399    BS01 1.00 BS02 1.00 BS03 1.00
4140011480459    BS01 1.00 BS02 1.00 BS03 1.00
5841011507527EK  BS01 1.00 BS02 1.00 BS03 1.00
5841011507528EK  BS01 1.00 BS02 1.00 BS03 1.00
5985011524173EK  BS01 1.00 BS02 1.00 BS03 1.00
6605012529480    BS01 1.00 BS02 1.00 BS03 1.00
6605012546944    BS01 1.00 BS02 1.00 BS03 1.00
6610011477221    BS01 1.00 BS02 1.00 BS03 1.00
6610012695437    BS01 1.00 BS02 1.00 BS03 1.00
6610013076363    BS01 1.00 BS02 1.00 BS03 1.00
6610013566949    BS01 1.00 BS02 1.00 BS03 1.00
6615010351092    BS01 1.00 BS02 1.00 BS03 1.00
6615010363198    BS01 1.00 BS02 1.00 BS03 1.00
6615012164822    BS01 1.00 BS02 1.00 BS03 1.00
6615012719168    BS01 1.00 BS02 1.00 BS03 1.00
6615012754675    BS01 1.00 BS02 1.00 BS03 1.00
6615012768318    BS01 1.00 BS02 1.00 BS03 1.00
6615012828765    BS01 1.00 BS02 1.00 BS03 1.00
6620012652887    BS01 1.00 BS02 1.00 BS03 1.00
VTM
1280011826304EK   1.00 1.00 1.00
1660012126399     1.00 1.00 1.00
4140011480459     1.00 1.00 1.00
5841011507527EK   1.00 1.00 1.00
5841011507528EK   1.00 1.00 1.00
5985011524173EK   1.00 1.00 1.00
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VITA

Captain Eric C. Lorraine was born on 6 June 1963 in Syracuse, New York. He graduated from East Syracuse-Minoa High School in 1981 and entered Clarkson University later that year. Captain Lorraine graduated in 1985 with a Bachelor of Science degree in Mechanical Engineering and was commissioned in May 1985 through the Reserve Officer Training Corps program. In April 1987, Captain Lorraine was called to active duty and was assigned to Chanute AFB, Illinois to attend initial training for aircraft maintenance. In September 1987, he was assigned to the 509th Bombardment Wing at Pease AFB where he worked in various positions in the Avionics, Field, and Organizational Maintenance Squadrons. Captain Lorraine was reassigned to the 27th Fighter Wing at Cannon AFB in September 1990 where he worked as the OIC of the 428th Aircraft Maintenance Unit and later, OIC of the 524th Aircraft Maintenance Unit. After the implementation of the objective wing structure, Captain Lorraine worked as the OIC, Sortie Generation in the 524th Fighter Squadron. In June 1993, Captain Lorraine entered the Graduate Logistics Management program, Graduate School of Logistics and Acquisition Management, AFIT. He was awarded a Master of Science Degree in Logistics Management in September 1994.

Permanent address: 6331 Fremont Road
East Syracuse, New York 13057

VITA

Captain Michael E. Michno was born on 30 October 1962 in Detroit, Michigan. He graduated from Cherry Hill High School, Inkster, Michigan in 1980 and went on to receive a Bachelor of Science degree in Acccunting in 1984 from Hillsdale College in Michigan. In October 1987 he entered Officer Training School. He was commissioned in January 1988, and assigned to Sheppard AFB, Texas for his initial transportation officer training. In May 1988, Captain Michno was assigned to Pease AFB, New Hampshire, where he served as Vehicle Operations Officer and Plans and Programs Officer. He also worked Presidential Transportation Support for President Bush, and worked all transportation management issues in the complete closure of Pease Air Force Base. In May 1991, Captain Michno was assigned as a Transportation Systems Analyst, at Headquarters Air Force Logistics Command, Wright-Patterson AFB, Ohio. He worked on the planning and design of the Logistics Airlift (LOGAIR) system, and acted as the headquarters' liaison for the Air Force's Water Port Logistics Offices. In June 1993, Captain Michno entered the Graduate School of Logistics and Acquisition Management, AFIT. Captain Michno has a follow-on assignment to Headquarters Air Force Materiel Command, Wright-Patterson AFB, Ohio.

Permanent address: 26932 Sheahan Drive
Dearborn Heights, MI

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13. ABSTRACT (*Maximum 200 words*)

Computer simulation was used to evaluate the impact of a Logistics Control Facility (LCF) with a Total Asset Visibility (TAV) system on the AF logistics system's ability to support a weapon system. For this study, the B-1B was chosen as the weapon system of interest. Two performance measures, expected fully mission capable rates and expected pipeline quantities, were used to evaluate the simulation results. Two-sample t tests were used to compare the current logistics configuration of the B-1B with that same configuration, but with an LCF controlling the movement of assets. The expected FMC rate performance measure showed significant results while the expected pipeline quantity performance measure did not. After determining that the LCF with a TAV system did have an impact on the ability of the AF logistics system to support a weapon system, fourteen different support configurations were evaluated. Variables included mode of transportation, use of buffer stocks, and use of intermediate repair facilities. Analysis of the results was accomplished using a randomized block ANOVA and Least Significant Difference comparison of means. For expected fully mission capable rates, mode of transportation was the most significant factor. For expected pipeline quantities, the use of intermediate repair facilities was the most significant factor.

14. SUBJECT TERMS
Logistics, Dyna-METRIC, Computer Simulation, B-1B, Information Systems, Two-level Maintenance

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